THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK JUNE, 1906

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

WHO HELPS ME I HELP

Eighteenth Annual Convention, Atlantic City, N. J., June 20-23, 1906

Among the trade conventions of the year, it is safe to say that none is looked forward to with keener anticipation than that of the National Master Steam Fitters' Association. In addition to the work done at these gatherings the Association has always maintained a reputation for providing a thoroughly good time for its members and guests. Whether this happy state of affairs is due to the Association's avoidance, so far as possible, of technical discussions in its deliberations, or whether the reason lies even deeper, possibly in the character of the Association itself, the fact remains that all who attend one of these meetings promise themselves never to miss another one.

This is the fourth time the Master

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HENRY L. HALL, NEW YORK
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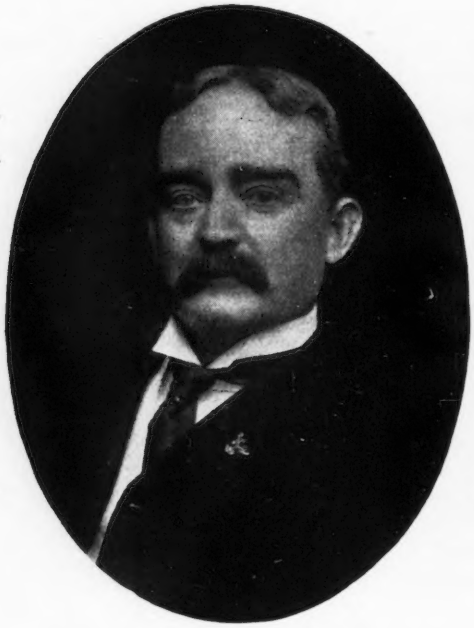
JOHN C. F. TRACHSEL, PHILADELPHIA, PA.
Sergeant-at-Arms, Master Steam Fitters' Association

Steam Fitters' have met at Atlantic City, and in this connection one of the most interesting features of the present convention will be the comparison that will be made between the membership roll of 1906 and that of 1902, when the first Atlantic City meeting was held. During the intervening years the list of members has been nearly, if not quite, doubled, and the rate of increase has never been higher than during the past two years, under the administrations of Presidents Henry L. Hall and P. Gormly.

This year the convention has not



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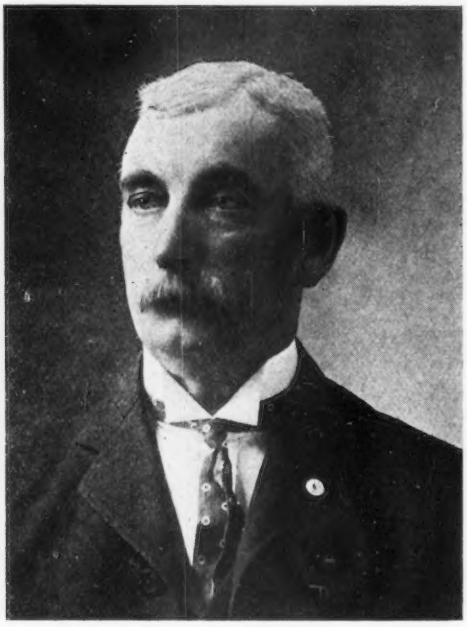

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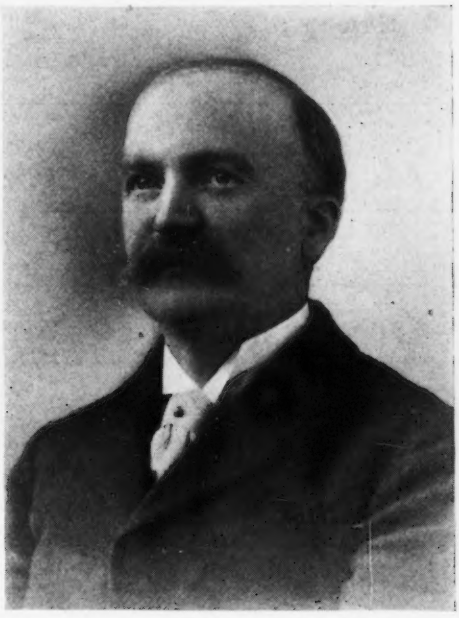
Director, Master Steam Fitters' Association



ARTHUR C. WALWORTH, BOSTON, MASS.
Chairman, Standardization Committee

only these exceptional increases to talk about, but also a number of other important matters, including the efforts in the direction of trade reciprocity, and the report of the Standardization Committee, which has been working during the past year towards establishing more fixed standards for pipe and fittings. As we stated at the time of the appointment of the committee, the work laid out for it is one involving several years of constant effort and therefore nothing more than a report of the committee's progress toward the end in view can be expected at this time.

The Schoolhouse—Its Heating and Ventilation

By Joseph A. Moore,
Inspector of Public Buildings, State of Massachusetts

Air Supply for School Rooms

III

The following tables give the average results of a number of tests of the air supply in schoolrooms made by the Massachusetts inspectors in different parts of the state in buildings of different size and construction, of wood or brick, under different conditions of temperature, wind, weather, humidity and barometric pressure.

These results are not to be considered as what is theoretically required, but such as may be expected in actual practice in schoolhouse ventilation.

The inside temperatures were taken at the breathing plane, at the four corner desks and at the teacher's desk at the same time.

Table Showing Average Results of Tests Made in 100 Ventilated Schools

Temperature, Degrees F.			Velocity at Inlet, Feet per Minute.	Net Available Area of Inlet, Square Feet.	Cubic Feet of Air per Minute Supplied at Inlet.
Outside.	Inside.	At Inlet.			
34.26	69.69	93.78	399.39	4.439	1,772.892

TABLE SHOWING AVERAGE RESULTS OF TESTS MADE IN 500 VENTILATED SCHOOLS WHEN OUTSIDE TEMPERATURE WAS BELOW 40° F. (FRACTIONS OMITTED IN THIS CASE.)

Temperature, Degrees F.			Velocity at Inlet, Feet per Minute.	Net Available Area of Inlet, Square Feet.	Cubic Feet of Air per Minute Supplied at Inlet.
Outside.	Inside.	At Inlet.			
25	70	92	377	4	1,508

TABLE SHOWING AVERAGE RESULTS OF TESTS MADE IN 500 VENTILATED SCHOOLS

Temperature, Degrees F.			Velocity at Inlet, Feet per Minute.	Net Available Area of Inlet, Square Feet.	Cubic Feet of Air per Minute Supplied at Inlet.
Outside.	Inside.	At Inlet.			
40.01	70.6	93.3	355.4	4	1,421.6

TABLE SHOWING AVERAGE RESULTS OF TESTS IN 1,040 VENTILATED SCHOOLS

Temperature, Degrees F.			Velocity at Inlet, Feet per Minute.	Net Available Area of Inlet, Square Feet.	Cubic Feet of Air per Minute Supplied at Inlet.
Outside.	Inside.	At Inlet.			
37.9	70.2	93.3	369.6	4.13	1,526.488

These tests show the amount and temperature of air supplied at the warm-air inlets, but do not include the additional amount of air brought into the room by leakage through walls, ceilings, floors, or through openings or cracks around doors and windows when the exhaust through the vent shafts was greater than the supply at the warm-air inlets; neither do they take into consideration the air forced out of the room through the same places when the conditions are reversed and the supply at the inlets exceeded the exhaust at the vent openings.

In some cases the air exhausted through the vent ducts was considerably in excess of the supply at the inlets, the difference being made up by *inward* leakage. In other cases it was the reverse, and *outward* leakage accounted for the difference.

These are average tests, and do not include those cases where a *great* difference was found between the amount of air supplied at the warm-air inlet and that extracted at the vent outlet. Sometimes the amount of air is more than double at the outlet the amount at the inlet, or it may be the reverse.

These cases occur in loosely-constructed buildings, or where proper adjustment has not been made of the dampers at the outlets or of the windows admitting air to the cold-air rooms where the indirect radiation is located. They are only mentioned to show the necessity of good construction and proper regulation of the exhaust and supply openings.

From a large number of observations it appears that in order to supply a schoolroom with 1,500 cubic feet of air per minute when the temperature outside is 30 degrees F. we shall have to introduce the air at the warm-air inlet at about 93 degrees F. to keep the room at 70 degrees F., at the breathing plane of the pupils, raising the temperature of the air 63 degrees F. 1,500 cubic feet of air raised 63 degrees equals 94,500 cubic feet raised one degree.

From the average tests of a large

number of unventilated schools we find that to keep a schoolroom at 70 degrees F. with the outside temperature at 30 degrees F., supplying 500 cubic feet per minute, we shall have to send the air in at about 180 degrees F. This is an increase of 150 degrees over the outside air.

Five hundred cubic feet raised 150 degrees equals 75,000 cubic feet raised one degree.

Assuming that it costs the same in each case to raise a cubic foot of air one degree in temperature, the increased cost of furnishing 1,500 cubic feet per minute to a schoolroom over the old method of furnishing 500 cubic feet per minute would be about 26 per cent.

The cost of heating schoolrooms varies considerably in actual practice, depending upon the construction and location of the building, the system of heating and ventilation installed, and the care and judgment exercised by the janitor.

A fair average allowance of fuel for good ventilation and proper warming may be considered as ten tons of hard coal per schoolroom per year. This includes all the space within the building occupied by corridors, basement and small rooms, in addition to the schoolrooms.

The following table shows the cost of heating eight schoolhouses by different methods during the winter of 1893 and 1894, and is given as showing the difference in cost that may occur under different conditions.

WARM-AIR DUCTS OR FLUES

One of the defects in the early attempts at ventilation was the small area of cross-section of the warm-air supply ducts. With the gravity system, when too small ducts were used, it was necessary that the air be heated to a very high temperature in order to give the required velocity to obtain the amount desired.

In a mechanical system, where a fan is used and the ducts are not large enough, the air will be forced into the room at too great a velocity, sometimes causing uncomfortable drafts. The fan will also require additional power in order to force the air through the small ducts at high velocity.

In a gravity system, the warm-air ducts should be of ample area to admit the air in sufficient quantity to meet the requirements of mild weather when it is only warmed to a moderate degree.

Many tests by the Massachusetts inspectors show that the best results are obtained when the warm-air ducts have a cross-sectional area of 24 x 36 inches (six square feet).

Five square feet, 24 x 30 inches, will give fair results, but 24 x 36 inches is to be preferred. This is for an ordinary schoolroom 28 x 32 x 12 feet, accommodating 50 persons.

Class-rooms a little larger or smaller than the above standard, or containing a greater or less number of persons, can have the warm-air ducts proportionately increased or diminished. In small rooms, or in large rooms having but few pupils, or where there is a large exposed wall or glass surface, or where no direct radiation is used, a liberal allowance should be made for the area of the warm-air ducts.

The top of the warm-air duct,

TABLE SHOWING COST OF HEATING EIGHT SCHOOLHOUSES BY DIFFERENT METHODS

Building.	Kind of Heat.	Ventilation.	Number of Rooms.	Cost of Fuel per Room.
1	Steam	Combination of supply and exhaust	10	$ 50.50
2	Steam	Combination of supply and exhaust	16	53.31
3	Steam	Plenum supply, no special exhaust	22	106.00
4	Steam	Plenum supply, no special exhaust	12	108.10
5	Furnace	Combination of supply and exhaust	12	60.75
6	Furnace	Combination of supply and exhaust	8	63.25
7	Steam	No modern ventilation	16	90.82
8	Furnace	No modern ventilation	13	63.53

where it enters the room, should be curved to easily change the direction of the entering air from a perpendicular to a nearly horizontal direction. The interior of brick warm-air and foul-air ducts and flues should be made as smooth as practicable, and rough projections of mortar should not be allowed. Where the expense can be incurred it is advisable to cover the inside walls of warm-air ducts with a light coat of adamant plaster or Portland cement to give a smooth surface and reduce the friction.

Galvanized-iron ducts should be made as tight as practicable.

Ducts constructed of laths and plaster, or of expanded metal and plaster, should not be used, as the leakage of air through them is very great.

The inlet opening into the room should be of larger area than the cross-section of the uptake duct in order to allow for the obstruction of the register face or grill covering the opening, and also to allow for the space at the bottom of the opening where there is little, if any, inflow of warm fresh air.

If a wire grill is used to cover the opening into the room the opening should be at least 30 x 36 inches where the uptake is 24 x 36 inches.

Where cast-iron register faces are used the opening should have an area of from 33 to 50 per cent. larger than the uptake, on account of the reduction of the available area and the friction of the register face. Cast-iron register faces are more expensive than wire grills, and, when placed above the floor level, cannot be recommended for covering warm-air inlets or foul-air outlets.

When two or more stories of the same building are to be supplied with warm air from the same source, and where the ducts all lead from one cold-air room, it is well to place the duct for the first story nearest the cold-air supply window. The first story duct, being of less height than the others, will have less lifting power than those to the second and third stories, and, consequently, should be placed where the supply is largest, especially if the cold-air room or duct to the heater is of limited capacity. If the duct leading to the second or third story is placed nearest the source of supply, being higher or longer than the one leading to the first story it will rob that duct of its fair proportion of air.

The opening in the duct where it receives the warm air from the heaters should be but a few inches above, or, better, on the level with the top of the indirect radiators or directly from the hot-air chamber of the furnace.

The opening for receiving the cold air for mixing and reducing the temperature of the warm air should be at the bottom of the duct and of an area equal at least to the cross-sectional area of the uptake duct.

The mixing damper for regulating the temperature should be hung at the bottom of the warm-air opening from the heater, and should incline upward toward the back of the duct. It should be operated from the schoolroom by means of a stout chain and suitable device for holding it in any desired position.

It is advisable in many cases to provide a sliding adjusting damper at the bottom of the opening where the warm air from the heater enters the uptake duct, in order that the supply of air to the different rooms may be properly adjusted.

Theoretically, the warm-air ducts leading to the upper rooms may be of less cross-section than those leading to the first story. In actual practice this is seldom done, and the adjusting damper or slide is used.

When a mechanical system is used and the air to the several rooms is forced by a blower or fan through one or more main supply ducts, and branches are taken off for the different rooms, a switch or adjusting damper should always be provided at the point where the branch leaves the main duct, and suitable means provided for holding the switch damper in any desired position.

The cross-sectional area of each branch and the reduction of area in the main duct as the branches are taken off should be calculated theoretically, making proper allowance for

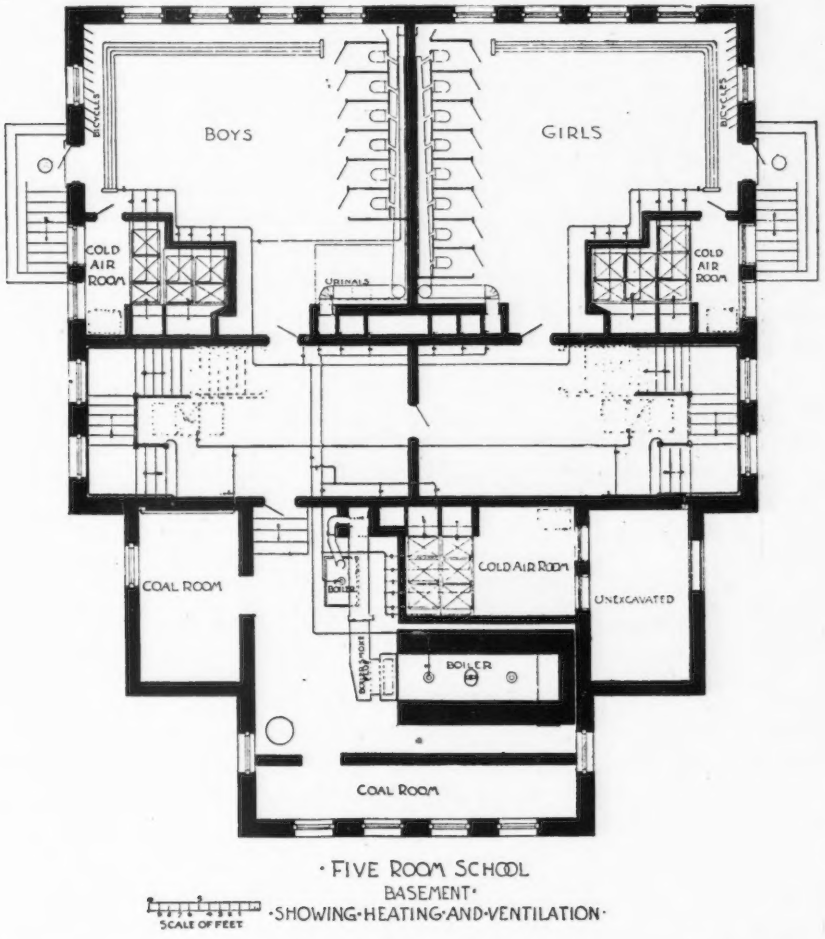
friction, but the switch dampers should never be omitted if proper distribution of air to the several rooms is expected in actual practice.

The writer has never seen entirely satisfactory results obtained under all conditions of wind and temperature where the switch dampers have been omitted, although the sizes of the different branches had been carefully designed according to the best theoretical rules. If a very strong north or northwesterly wind was blowing, the switch dampers could be adjusted to meet the existing conditions; but if the wind was from the south or southeast a different adjustment of the switch dampers would be required.

Where a fan or blower has been used and the ducts had not been designed of suitable size and the air entered the room at too high a velocity, causing uncomfortable drafts, the writer has in some cases to a considerable extent overcome the difficulty by placing inside and against the grill a wire screen made of ordinary iron mosquito netting. Where this is used the grill should be arranged so that is can be easily taken out to clean the screen occasionally.

Although this screen will be an obstruction and require a little more power, yet it is better than to have the uncomfortable drafts.

This mosquito-screen netting should



ARRANGEMENT OF HEATING AND VENTILATING APPARATUS IN BASEMENT OF TWO-STORY SCHOOL BUILDING

only be used where a mechanical (fan) system is in operation, and should not be used with a gravity system.

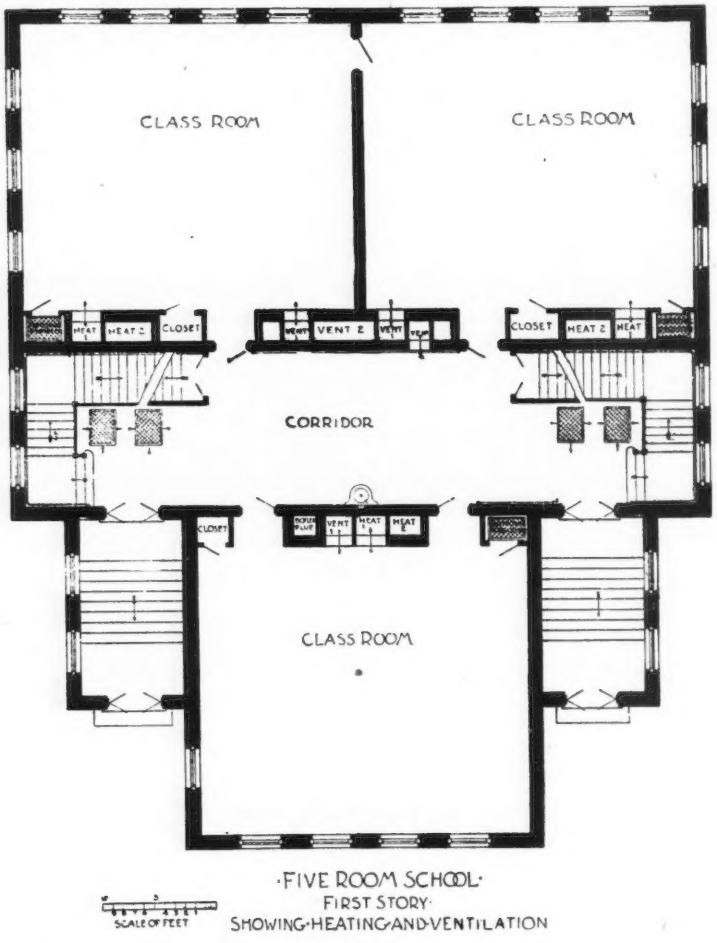
HEATING AND VENTILATING A SMALL SCHOOL BUILDING

The accompanying illustrations show a typical method for heating and ventilating a two-story, five-room school building.

The building is constructed of red brick with granite trimmings, slated roof and copper gutters. There are four class-rooms and one large assembly-room or hall, which can, if desired, be divided into two class-rooms; also two small rooms in the second story for the use of the teachers. In the basement which has a concrete floor with a covering of Portland cement, are two sanitary rooms, cold air rooms, boiler rooms and fuel rooms.

The class-rooms are of standard size, 28 x 32 x 12 feet, intended to accommodate 49 pupils each. Transoms are over each door except in the basement. The doors from the class and assembly rooms open into the corridors, and each has a large glass panel in the center to enable the teachers to see into the corridors.

The corridors are 15 feet wide, with special racks on the walls for clothing.



PLAN OF FIRST FLOOR OF TWO-STORY SCHOOL BUILDING, SHOWING LOCATION OF AIR INLETS AND OUTLETS

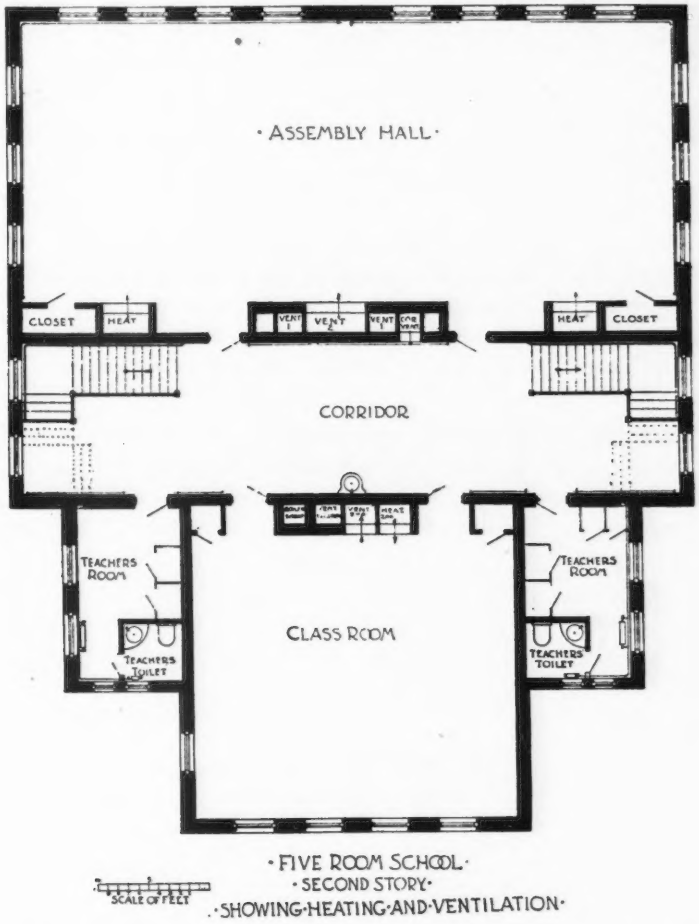
The warm fresh air is admitted into the class-rooms through openings covered by wire grills 36 x 30 inches. The bottom of these openings is eight feet above the floor. In the assembly room the grills are 54 x 30 inches. The warm-air flues to the class-rooms are 36 x 24 inches (six square feet),

and in the assembly room are 54 x 24 inches each. Each warm-air flue is provided with a galvanized-iron damper or mixing-valve to regulate the temperature of the incoming air without materially decreasing the supply.

The foul air is taken out at the floor level through wire grills, 30 x 24 inches (five square feet). In the assembly room the outlet grill is 72 x 24 inches (12 square feet).

assembly-room vent-flue are placed nine sections (45 square feet) of the same kind of radiators. These radiators are placed about one foot above the top of the vent opening from the room, evenly spaced, and inclined upward and across the flue.

A vent-flue, 24 x 24 inches inside measurement, is provided for the corridors, both corridors venting into the same flue, and 15 square feet of



PLAN OF SECOND FLOOR OF TWO-STORY SCHOOL BUILDING

Each foul-air outlet vent, except the sanitary vents, is provided with a galvanized-iron damper to regulate the outflow or shut it off when the building is not occupied.

In each class-room vent-flue are placed four sections of cast-iron smooth-surface radiators, each having five square feet of radiating surface (a total of 20 square feet). In the

radiation is placed above the lower corridor vent opening.

The sanitary vent-flues are each 20 x 24 inches and contain 15 square feet of radiation.

The heating is by a horizontal tubular boiler, 54 inches in diameter, 15 feet 3 inches long, containing 60 three-inch tubes, 14 feet long, and rated at 48 horse power.

A small sectional boiler is also provided for heating the vent-flues when the large boiler is not in use.

The piping for the vent-flues is so connected that either the large or small boiler can be used as desired. Each vent-flue heater is separately valved, both on the supply and return pipes.

The radiation for each class-room consists of 400 square feet of cast-iron indirect pin radiators, of 20 square feet per section, made into there stacks of 120, 140 and 140 square feet—one section, two sections or three sections to be used as may be required. Each section is to be separately piped and valved.

The assembly hall has two distinct groups of indirect radiation, 480 square feet each, and each group is made up of four stacks, separately piped and valved. Around the outside walls are two lines of one-and-one-fourth-inch steam-pipe for use when the assembly hall is not occupied.

Two foot-warmers, each of 120 square feet, of the same kind of radiation used for the class-rooms, are provided in the lower corridor.

Two lines of one-and-one-fourth-inch steam pipe are also provided in the corridors and placed under the clothing racks for drying the clothing in stormy weather.

The sanitary rooms are heated by four lines of one-and-one-fourth-inch pipe placed near the ceiling.

Direct radiators are placed in the teachers' rooms and toilets.

In the floor of a closet in each class-room is placed a register connecting with the cold-air room below. A tight-fitting shutter of galvanized iron is placed below the register to shut off the cold air from below when the register is not open. These registers, called rotating registers, are. for rotating the air through the building when the schools are not in session.

The ventilation of the sanitary rooms and basement is through the fixtures, each closet having a four-inch diameter seat vent connected with a galvanized-iron duct leading from each line of closets and from the urinal to a steam-heated vent-flue.

The air from the sanitary rooms being taken out through the closets and urinal vents prevents odors passing out from these rooms into the building, as is sometimes the case when the room is vented by an outlet separate from that provided for the sanitary fixtures, or where air is forced into the sanitary room by a fan or gravity supply from the heating system.

A plenum condition should never be allowed in such rooms. An exhaust should be used instead of a plenum.

Sufficient air will be supplied to keep the sanitary rooms free from odors, if taken into the sanitary rooms through a wire grill placed in the bottom of the doors leading from the basement corridor, and if the sanitary vent-flues are properly heated.

[*In the July issue Mr. Moore will continue his remarks on Air Supply for School Rooms, and will supplement them with plans of another typical schoolhouse heating and ventilating system.*]

Working Out a Ventilating System for a Telephone Exchange

The Plant Designed for the Operating Room of the Cuyahoga Telephone Company

By Louis Rosenberg

In the description of the plan designed for heating and ventilating the operating room of the Cuyahoga Telephone Company, it will only be necessary for our purposes to say that the cubical contents of the room are approximately 75,000 cubic feet; that it was desired to have eight changes of air per hour and, allowing for heat losses, it was necessary to supply 10,000 cubic feet of freshly warmed air per minute to maintain a temperature of 70°. The room is occupied, during the day, by from 75 to 90

persons. The heating and ventilation is combined in one system of indirect radiation.

The accompanying illustration (Fig. 1) will show the general appearance of the room. Before undertaking the work, a number of systems in buildings in other cities were visited, which it may be said in passing, proved most disappointing. One of the main reasons for this appeared to lie in the construction of the buildings themselves. For instance, the architect, when designing a building, apparently forgets ventilation. ness of builders to consider elaborate systems. We found in most cases that the apparatus is much too small and that the arrangement of distributing vents, in many cases, was such as to cut the efficiency of the plant down about 25% to 50% and that where the apparatus was large enough and the vents of proper dimensions, the failure was very often due to the method of introducing and distributing the air.

TESTS OF THE AIR

Before deciding upon an upward or downward system for the ventila-

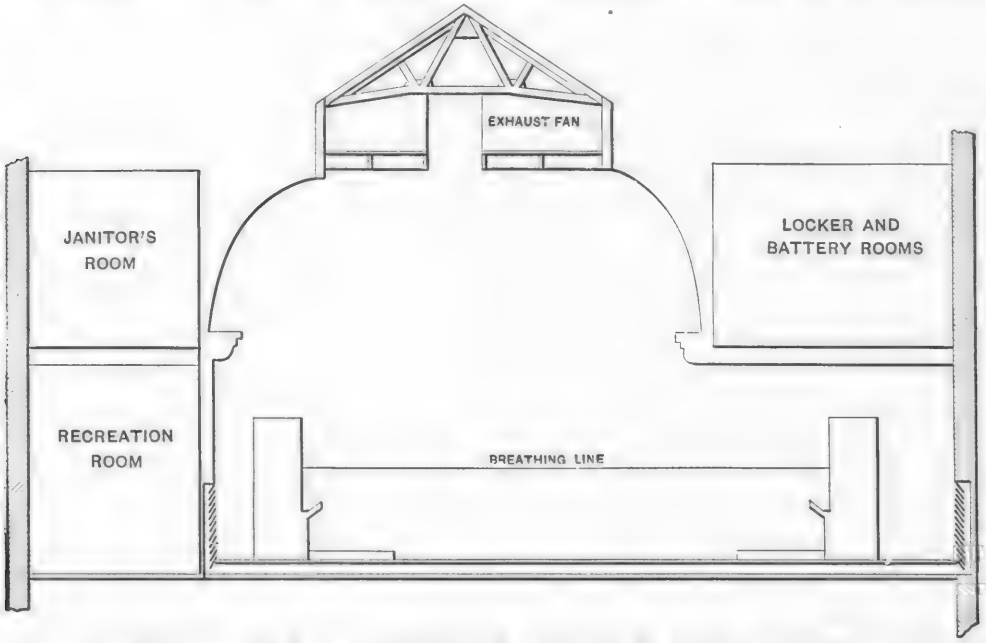


FIG. 1. SECTIONAL VIEW OF TELEPHONE EXCHANGE ROOM SHOWING LOCATION OF SWITCHBOARD AND BREATHING LINE

The Registers in the Side Walls were Discarded for Pedestal Registers

When his design is completed and the layout decided upon, he calls upon ventilation engineers to plan the ventilating system. The latter is seldom given sufficient space to properly install his apparatus and therefore places it in whatever corners and passages are left at his disposal. Another point, no doubt responsible for so many poor installations, is that the ventilation equipment is a modern improvement which is not only continually depreciating in value with its daily operating expense, but is an improvement which cannot demand a higher rent. Hence the unwillingtion of this room, a number of experiments were made by testing the air at four different levels under varying conditions and at seven different positions in each level. Carbon dioxide was used as the indicator of impurities. The accompanying tables show the tests made, the results of which were plotted upon Figure 2.

Following is a record of the tests:

TABLE I.

Curve 1.—Wed., July 19, 1905.

Windows, doors, skylights open. Present ventilation plant not used.

Height above Floor in feet	Parts carbon dioxide in 10,000
2½	6.813
7	7.992
9	8.247
14½	6.907

TABLE II.

Curve 2.—Thurs., July 20, 1905. Windows, doors, etc., closed. Present ventilation plant not used.

Height above Floor in feet	Parts carbon dioxide in 10,000
¼	10.695
2½	12.002
7	14.370
9	15.10
14¼	15.008

TABLE III.

Curve 3.—Present ventilation plant used. (Downward system.)

Height above Floor in feet	Parts carbon dioxide in 10,000	Remarks.
2½	8.527	
7	7.157	
9	6.472	
14½	4.836	Test stopped after three determinations. Cause, one operator overcome by foul air.

An examination of Tables I and II shows the degree to which exhaled air rises. In the first experiment, it will be noticed that the height at which the point of inflection in the curve occurs is lower than that in the second. This, of course, is due to the fact that, when the foul air cools sufficiently to counteract the lightness of the water vapor contained in exhaled air, and when its density increases due to the cooling, the foul air is heavier than the surrounding air and begins to descend. Thus the turning point in Curve 1 is at 9½ feet, whereas in Curve 2, it is at 12¼ feet. This is easily explained when we remember that cool, fresh air was supplied in the first experiment, whereas in the second, no fresh air entered the room and, therefore, it required more time for this cooling.

Table III, Curve 3, shows that, with a downward system such as that in use in the operating room at the time of the experiment, the distribution of impurities is reversed. Examinations of Curves 1 and 3 show that the degree of impurity in the two tests is equal at 5¼ feet. This means that if our heads are at this height, the impurities are the same. At a higher point, the impurities are less in Curve 3, for the downward current of fresh air is strong enough to force the foul air to the floor. At a lower point, however, the impurities rise at first, are then cooled and finally descend. In the operating room in question, the height of the operators' mouths and noses is from 4 feet 4 inches to 4 feet 8 inches. Hence from the curve, the operators must rebreathe the exhaled air when the downward circulation is employed.

UPWARD SYSTEM OF VENTILATION CHOSEN

The conclusions reached by these tests led us to decide on an upward system of ventilation, with the air brought in at or near the floor line and with an exhaust near the ceiling. We also determined to make the number of inlets and outlets as numerous as possible on the theory that, in an ideal system, the entire floor should be a register through which air should enter at a very small velocity and that the entire ceiling should serve as an outlet register.

Registers placed in the floor are, of course, open to the objection of proving receptacles for dust and dirt and, owing to the construction of this operating room, containing a switchboard along the sides of the room not far from the wall, it was not practicable to place the inlet register in the side walls near the floor line. The plan finally decided upon was that of pedestal registers, shown in Fig. 3 and placed at the points shown in Fig. 4.

APPARATUS PLACED ON ROOF OF BUILDING

The size and arrangement of the proposed plant make it necessary to install the apparatus on the roof of the building. This has its advan-

tages, since there is no need there of a fresh air shaft to the fan and the main flue from the fan to the operating room may be substituted for one much shorter and very much better located. Indeed, after having decided upon the roof as the place for locating the apparatus, we found it greatly simplified matters. In summer, for instance, we could obtain cool, refreshing air which swept in from the nearby lake, and in winter the air could be taken, at times, from the building itself. In this manner we were able to eliminate the tempering coil, since we could utilize the heat of the building to temper the air slightly before it reached the cleansing apparatus. With the plant in the basement, this would not have been possible. For safety's sake, however, we provided space for a tempering coil, in case we should find it to be necessary. By its omission, we saved, or at least postponed, the expenditure of several hundred dollars.

AN IDEAL HUMIDIFYING APPARATUS

As it was our desire to provide for the thorough cleansing and humidifying of the air before it entered the operating room, we went to considerable trouble to accomplish this end The ideal system especially for theaters and similar public buildings, is undoubtedly one in which an air washer is used in connection with an ice machine for lowering the temperature. For example, in the room under discussion, we know that our blower is to supply 10,000 cubic feet of air per minute. 10,000 divided

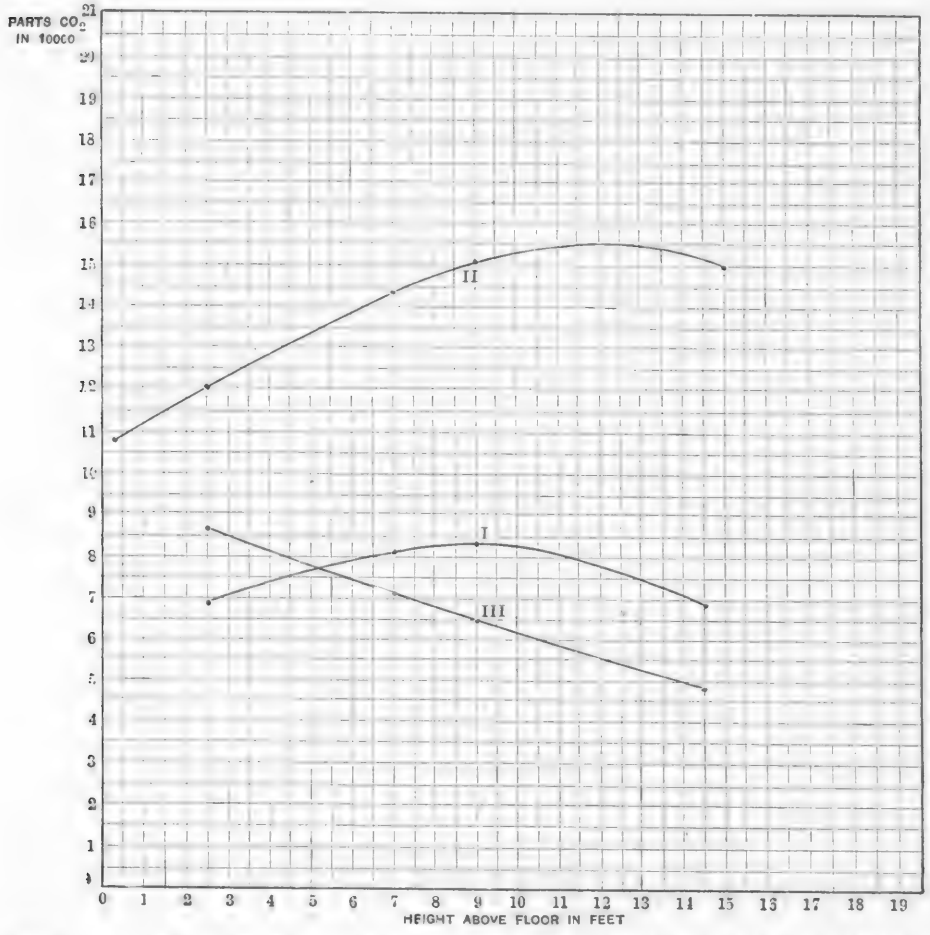


FIG 2. RESULTS OF TESTS OF PURITY OF AIR, PLOTTED FROM TABLES I, II AND III

by 13 equals 770 lbs. of air per minute. From a hygrometric table at hand, we find that when air is saturated at 70°, it has 7.94 grains moisture, while at 65° it has 6.81. Interpolating for 68°, the air when saturated will contain 7.488 grains per unit volume. But since we propose to admit the air into the room at 68°, but with a relative humidity of 65%, it should contain .65 x 7.488, equals 4.8672 grains absolute.

Referring to the table, we find that saturated air at 53°, contains 4.8672 grains. Hence, if our air be saturated and cooled to 53°, then heated to 68°, no more moisture being admitted or removed, the relative humidity will be $\frac{4.8672}{7.488}$ equals 65%. This is the theoretical statement. Now for the number of heat units involved in most unfavorable weather. Assuming maximum temperature of outdoor air to be 100°. Then 100°, minus 53°, equals 47°, dropped to cool the air to the point at which we wish to saturate it.

770 lbs. x 47 drop x .23 sp. ht. equals 8783.7 B. T. U. to be absorbed by the water. Allowing 5%. margin between water and air, because the air cannot possibly be cooled to the same temperature as the water, we have 53° minus 5° equals 48° as the temperature at which the water is to be maintained.

Suppose then, that the water be cooled at 38°. This gives a 10° rise, hence the capacity to absorb 10 B. T. U., since 1° is equivalent approximately, to 1 B. T. U. Hence, each pound of water absorbs 10 B. T. U.

$\frac{8783 - 7}{10 \times 8 - \frac{1}{3}}$ equals 105.3 gallons to be cooled per mintue. This makes a 20-ton ice machine necessary. If then an air washer be used and if the air be cooled by the cold water coming from the ice machine, and then re-heated to the proper temperature to be admitted to the room, we have accomplished precisely what is desired. The air is washed most thoroughly, cooled and saturated and then brought back to any humidity at the desired temperature.

It should be noted that the air in such an arrangement would be cooled by contact with cold water and not by being passed over a refrigerator coil. The latter should be placed in the water tank used as a supply for the air washer. Attempts to cool air by contact with the refrigerating coils are necessarily inefficient for the reason that, as the air passes over the coils, the latter become coated with frost on account of the deposit of moisture carried by the air. Frost being one of the best heat insulators, allows the air to pass over the coils without leaving any of its heat behind. On the other hand, if the coil be immersed in a water tank, that water can be cooled quite easily and at a high efficiency.

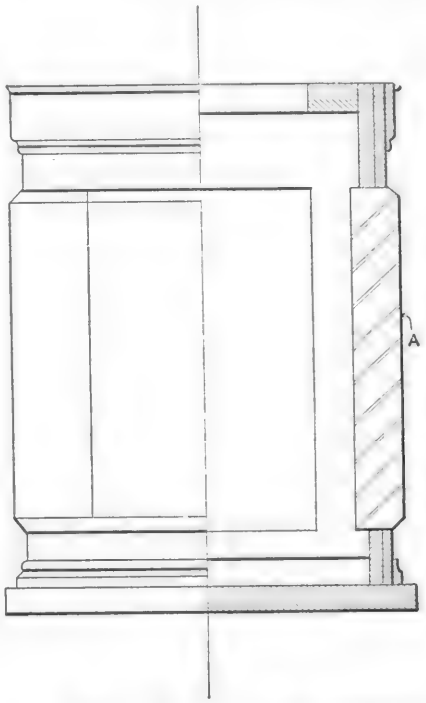


FIG. 3. DETAIL OF ONE OF THE PEDESTAL REGISTERS
A. Controlling Dampers

COKE SCREEN USED

For obvious reasons, notably the matter of expense, we had to forego the installation of such a device and in its place chose a coke screen (Fig. 5), designed for wet cleaning with a limited supply of water. It will be seen, by reference to the illustration,

that our apparatus is really a basket about 12 inches thick, filled with good porous coke. The latter is kept moist by the spray pipe, as shown in the figure.

BLOWER AND RE-HEATING COIL

In order to supply 10,000 cubic feet of air per minute to the operating room, we chose a 110-inch blower, as we wished to allow 50% for loss in transmission through the air ducts. A 110-inch blower will deliver 9,580 cubic feet of air at 150 R. P. M. and 14,385 at 225 R. P. M. As we needed at least 10,000 plus 10% for friction, we had really 11,000 cubic feet to figure on. Hence, it is evident that the blower selected was the proper one, for it supplied the necessary volume at a moderately low speed. This was especially necessary in this case, because of the proximity of the blower to operating room.

The blower is belted to a 7½ H. P. motor, instead of being direct connected on account of the slow speed. The frame of the motor must be exceedingly large to give a speed of 150 to 175 R. P. M. and at the same tims develop 7½ H. P., so that it was much cheaper to use a high speed motor and gear down the blower. The blower and motor were connected by a noiseless chain instead of a leather belt, because the former permits a shorter center to center between blower and motor. As a speed regulator was used, this outfit gave us a blower which would deliver the required amount of air without too much pressure and no chance for noise by the fan's rotation.

The re-heating coil was built in four sections, separately controlled by a by-pass. There are 100 one-inch pipes, 5 feet high per base, thus making a total of 2,400 linear feet of

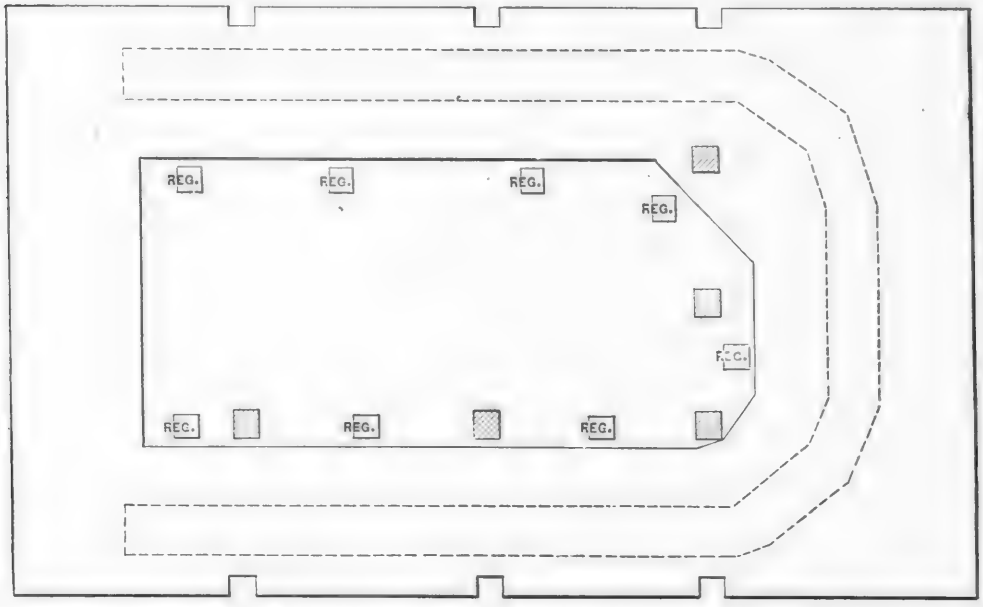


FIG. 4. PLAN SHOWING DISTRIBUTION OF PEDESTAL REGISTERS

piping. The velocity of the air $\frac{\text{quantity}}{\text{area of heater}}$ equals 420 feet per minute, not too large for heating moving air. A thermostat is installed in the operating room, whereby the chief operator can control at will the entering air.

FRESH AIR SUPPLIED FROM PLENUM CHAMBER

Instead of using distributing ducts, is was decided to build a plenum chamber directly under the floor of the operating room supplied with air at three points. As the air is mixed to the proper temperature immediate-

ly after leaving the heater and by-pass beneath it, the whole could be carried to the plenum chamber in one large duct. But in this case, it was more convenient to connect to

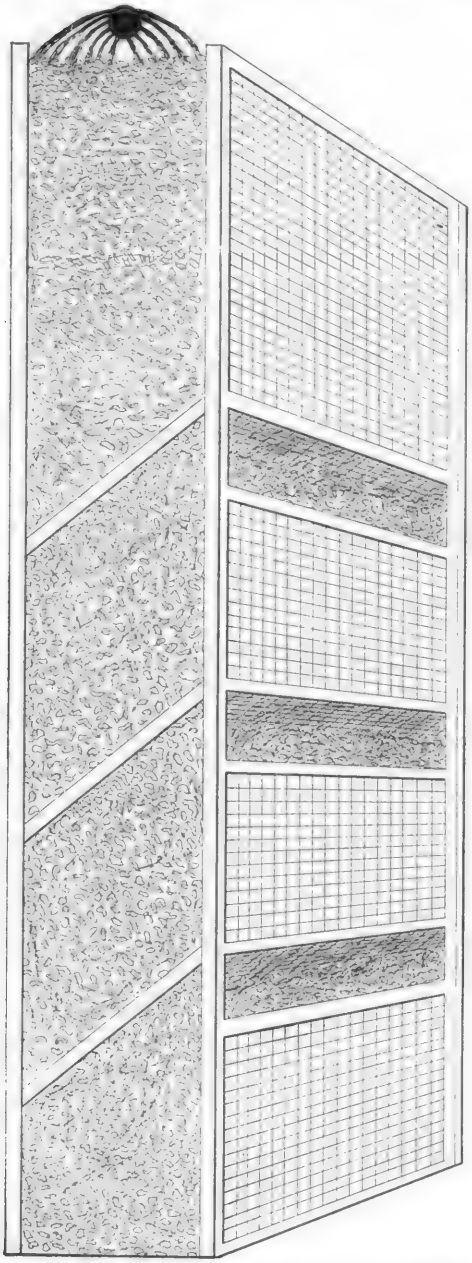


FIG. 5. COKE SCREEN USED FOR FILTERING AIR

the plenum chamber at three points. The air passes first to a single duct, running from the heater into the housing over the skylight. This duct then subdivides into three smaller ones, each having one-third the area of the large one and these pass down through the skylight. They are made to conform with the arched ceiling and pass down alongside three of the columns into the plenum chamber underneath the floor.

PLENUM CHAMBER UNDER FALSE FLOOR

The plenum chamber is provided by placing a second floor over the present floor, the height of this false floor is to be the same as a platform on which the chief operator's desks are set. The platform around the room forms the boundary of this false floor. Hence the operators will walk to their positions on a platform lower than the floor, instead of the previous arrangement where this platform was higher.

The building of this floor presented many difficulites. The height was necessarily limited to 11½ inches, thereby making the cubical contents small. It was, therefore, very essential to take up as little space as possible in the supporting of such floor. Joists were evidently out of the question because they would interfere to too great an extent with the continuity of air volume. It was, therefore, found best to use a large number of small iron supports, screwed to the present floor.

The pedestal registers connect directly with this plenum chamber and they are equipped with dampers so that the air may be directed upward at an angle; or shut off entirely from any or all sides.

An exhaust fan in the housing over the skylight was the last step in the design of this plant. The fan was built to pick up the air at a low velocity and send it out at a maximum velocity. In order to keep the velocity low, a 48-inch fan is used at about 180 R. P. M. so as to enable the velocity of the air to be kept within 9,000 cubic feet per minute. This fan is belted to a 3 H. P. motor.

DAILY COST OF OPERATION

Heating coil, 2,400 lineal feet equals 800 square feet radiation. Tempering coil, 700 lineal feet equals 240 square

feet radiation. Total, 1,018 square feet of radiation.

One square foot of radiating surface dissipates 290 thermal units per hour. Therefore, 1,018 x 290 equals 295,220 thermal units used per hour.

To condense water, divide by 1,000. Hence, 295.22 pounds water are condensed per hour. Divide by 10 gives approximately 29.5 pounds coal per hour.

For a run of 14 hours, 29.5 x 14 equals 413 pounds are burned. 413 / 2,000 x $1.90 equals $.39235 per day of 14 hours.

One 7½ H. P. and one 3 H. P. motor, run at 3 and 6 H. P. respectively will consume approximately 10½ x 746 watts per hour, or 7,833 watts per day of 14 hours. This would be 109,662 watts and at 2 cents per kilowatt an hour, equals 2.193, making a total of $2.585. Allowing $.165 per day for other expenses, such as oil, waste etc., we have a total of $2.75 per day as a maximum figure for the operating expense.

TEST TO DETERMINE DISTRIBUTION OF BACTERIA

Mention may be made of additional tests to determine the distribution of bacteria in the operating room. To accomplish this, 12 Petri dishes were distributed around the room at three different heights. The first four were placed, one in each of the four corners of the floor, enclosed by the platform. The second set was placed four feet above these points and the last set was placed on chairs located on the switchboard. After cultivation for a period of 10 days, the bacteria were examined under a microscope. The distribution was found to be:

Position	Colonies
1.	15
2.	10
3.	9
4.	13
5.	3
6.	2
7.	1
8.	2
9.	8
10.	11
11.	6
12.	7

From these experiments, it may be inferred that the bacteria are more numerous near the floor line, that at the breathing line they are least numerous, and that at a height of seven feet they are less than at the floor line but more numerous than at the breathing line. The smaller number of bacteria found at the breathing lines is explained by the fact that, in inhaling the air through the nose and mouth, the bacteria are deposited upon the wet organs, where they remain.

Automatically Testing the Purity of Air

A Portable Apparatus That Indicates the Proportion of Carbon Monoxide

By Albert Levy

Director of the Chemical Department at the Montsouris (France) Experiment Station.*

Translated for The Heating and Ventilating Magazine.

We have shown in a previous article† that carbon monoxide is not only dangerous when it kills, but also when it is found in any appreciable quantity. By numerous experiments, we have proved that, even in traces, carbon monoxide may seriously affect one's health; especially if the stay in such an atmosphere is somewhat prolonged. By numerous experiments, we learned that defective heating and lighting systems spreads the toxic gas in our rooms, and that many ailments, hitherto of unsuspected origin, are caused by the presence, in traces, of carbon monoxide.

How shall we discover and measure traces that may amount to one or two hundred-thousandths? Till now methods of analysis have been entirely insufficient.

Absorption of carbon monoxide by

* From *La Technique Sanitaire.*

† This artic e appeared in our March (1906) issue.

copper protochloride, ammonical silver nitrate or palladium chloride, etc., were always very incomplete; the dosage was of value only when the proportion of the toxic gas was sufficiently great.

No doubt, M. Gréhaut's fire-damp meter gives excellent results but the process, which consists at first in extracting the carbon monoxide from the blood of a mammal, could not enter into the usual practice of a chemical laboratory.

M. A. Pécoul and I have sought for means of detecting monoxide of carbon, even in the state of trace, by an automatic process so that everybody can use it in the different apartments of his house. Our working process is as follows:

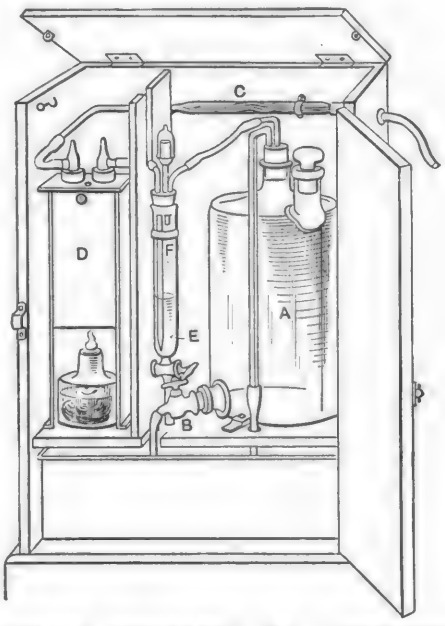
DESCRIPTION OF APPARATUS

The air drawn by a hydraulic apparatus, operated simply by a flow of water from a bottle, is freed from its dust by being made to pass through a column of cotton absorbent, and is then run through a U tube filled with anhydrous iodic acid. The tube is heated by an alcohol lamp to a temperature varying from 70 degrees to 80 degrees, C. The air is conducted next into a tube holding some cubic centimeters of chloroform. If the air under examination contains only traces of carbon monoxide, the liquid turns a rose color, more or less deep according to the proportion of the toxic gas.

The shade of color in the tube is then compared with a scale of colored liquids kept separately in sealed tubes, and on which is read at once the amount of carbon monoxide. Beginning with one two hundred-thousandths of carbon monoxide, a pretty distinct rose color is obtained.

In receiving the vapor of iodine directly into a liquid as volatile as chloroform, it was necessary to prevent the very rapid evaporation of this liquid; this we effected by simply covering the layer of chloroform with a column of distilled water, in which the volatile liquid is constantly condensed as it rises.

The arrangement of the iodic acid tubes requires certain indispensable precautions, and especially the use of an absolutely pure anhydride. We should show by a side experiment that the iodic acid gives no traces of iodine. This operation is necessary, especially after an anlaysis that may have given out appreciable quantities of iodine. In that case, it will be necessary to allow to pass enough air deprived of carbon monoxide so that



PORTABLE APPARATUS FOR DETECTING AMOUNT OF CARBON MONOXIDE IN ROOMS OR ELSEWHERE

A. Bottle filled with water which acts as a hydraulic device to draw air into the apparatus
B. Cock operating water bottle
C. Cotton absorbent through which the incoming air is drawn
D. Box holding a U tube, filled with anhydrous iodic acid
E. Tube partially filled with chloroform
F. Column of distilled water

every trace of iodine may have disappeared.

By means of this method, we have been able to arrange a simple, portable apparatus, requiring no chemical manipulations, getting into action at once by opening a cock and lighting a night-lamp and giving accurate results by operating on from three to five liters of air.

The absorption of the iodine is complete, for a proof tube placed beyond the first is never colored.

We can thus avoid the difficulties of removal of air and transportation

of it to the laboratory. All that is necessary is to place the apparatus in the suspected premises, set it in action at the moment desired and verify on the spot, not only the presence, but the proportion of carbon monoxide, which can be found to one hundred-thousandth, nearly.

This apparatus ought to be especially useful in private dwellings, schools, hospitals, shops, etc.

HOW TO USE THE APPARATUS UNDER UNUSUAL CONDITIONS

If it is desired to utilize the device for the examination of the special atmospheres found in certain industrial establishments, we would have first to eliminate the gases that can act on iodic acid at from 70 degrees to 80 degrees, C.

ACTION OF ACETYLENE

We have asked ourselves what could be the action of acetylene. In his important researches on the combustibles of the air, that have become classic, M. Armand Gautier has shown:

1st. That carbon monoxide mixed with air reacts wholly on iodic anhydride, heated to from 65 to 70 degrees, C., whatever may be its dilution and even to the smallest particle.

2nd. That acetylene reacts on iodic anhydride, even at 35 degrees, C., but that the reaction is incomplete. With dilutions of 10 volumes to 20 for 1,000 volumes of air only a fraction is oxidized, varying between one and two-tenths.

Our experiments show that, with still greater dilutions, the fraction of oxidized acetylene continues to diminish. For example, a mixture of 4 volumes of acetylene in 10,000 volumes of air gives us with the chloroform only an imperceptible tint, which corresponds not even to one-half-hundred-thousandth of our colored scale.

In these same conditions, the passage of a like volume of air (3 to 5 liters) containing a single ten-thousandth of carbon monoxide, that is to say, a dilution four times greater, gives us an intense coloration.

A mixture of one volume of acetylene in 10,000 volumes of air produces no coloration.

Therefore, in the conditions in which we employ our carbon monoxide indicating apparatus, the action of acetylene, admitting even, which is doubtful, that its presence is proved in dwelling places, would not influence at all the quantitative and even qualitative determination of carbon monoxide.

Meeting of British Heating Engineers

The British Institution of Heating and Ventilating Engineers held its summer meeting at Bath, England, June 18 to 20 last. Among the American engineers present was Professor Kent, of Syracuse University, former president of the American Society of Heating and Ventilating Engineers. The professional papers included, "The Warming of Steamships," by Charles R. Honiball, of Liverpool, and "The Labor Problem," by Mr. F. S. Russell, of London. Among the social features arranged were a visit to the old Roman and modern baths at that place and a trip through the Avon Valley to Trowbridge, and thence to Longleat Park, passing the residence of the Marquis of Bath and proceeding to Shirewater Lake, where lunch was served. The party was then driven to Bratton, the return trip to Bath being made by rail.

American Foundrymen's Association

The American Foundrymen's Association, which held its eleventh convention June 5, 6 and 7 last, at Cleveland, Ohio, was addressed by General Manager W. K. Barrows, Shenango Furnace, Sharpsville, Pa., on "Influences of Different Ore Mixtures on the Resultant Pig Iron, from the Standpoint of the Foundryman." Among the other speakers, Alexander E. Outerbridge, Jr., of Philadelphia, read a paper on "The Beneficial Effect of Adding High Grade Ferrosilicon to Cast Iron," and President H. A. Croxton, Massillon Iron & Steel Company, Massillon, Ohio, discussed "A Modern Pipe Foundry."

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A MOVEMENT which, if successful, will open up an avenue of increased business to ventilating engineers and contractors in New York and vicinity, has been inaugurated by the Charity Organization Society of New York. As has long been known in a general way, many of New York's lodging houses, of which there are hundreds in the city, are not only daily violating the sanitary code, but many of them are so built as to prevent the effectual ventilation of toilet rooms, as well as of sleeping rooms. Many cases have come to the attention of the Charity Organization Society in which the ventilation of toilet rooms is accomplished directly through the sleeping apartments.

As a result of this investigation, an effort is being made to compel the owners to install at least some form of mechanical exhaust ventilation in practically all lodging houses containing any considerable number of occupants. The plan now being considered, as being one that could be adopted at a reasonable figure, provides for one large flue leading through the bedrooms to the roof of the building and connected there with an exhaust fan. Ducts from the various bedrooms as well as from the toilet rooms could then be connected to the main flue. We understand the Society has already obtained sufficient evidence to compel a large proportion of the owners to install some form of ventilating device in their lodging houses.

IN THE description, published on another page, of a portable apparatus for detecting the amount of carbon monoxide in the rooms of dwelling houses, as well as of other buildings, it would seem that a long step in advance has been made towards providing a practical method of determining the quality of air in such apartments. Former President William Kent, in his presidential address before the last annual meeting of the American Society of Heating and Ventilating Engineers, said on this subject:

"We have means of automatically regulating the temperature of a room, but we have no means of automatically regulating the purity of the atmosphere in it. Not only this, we have as yet no means of even indicating the purity of the atmosphere in any convenient manner."

As the amount of carbon dioxide is easily determinable by apparatus already on the market, it will now be possible, by means of this new device, to discover practically all the dangerous impurities in the air with comparatively little trouble.

IN a recent hot blast system of heating and ventilating the designing engineer took the trouble to calculate the kind and size of apparatus

that would be required to cool the building in addition to that required to heat it. This kind of work is so seldom done by the average steam fitter that the method of procedure and calculations will be of interest. They will be found in this issue, in connection with an article on the ventilation of a telephone exchange. As cooling devices will no doubt be the next luxury in the ventilation of buildings, the writer points out that ventilating systems should be designed with this possibility in view. In this connection, he makes a point in favor of upward ventilation on the ground that a gradual motion of cool air upward will furnish the cooling sensation of an ordinary fan.

A TEST of a downward system of ventilation, formerly in use in the building just referred to, showed a proportion of carbon dioxide at various levels which would seem to bear out the theory recently expressed in our columns as to a "standard of impurity" being maintained in a downward system. For instance, at a height of 14½ feet, there was a proportion of about 5 parts of carbon dioxide in 10,000, while at the breathing line, there was between 7 and 8 parts. This is explained by the fact that air, upon leaving the body, inevitably ascends to some extent before its course is deflected downwards by the pressure of the downcoming air. The occupants, therefore, according to the test, are undoubtedly breathing, to some extent at least, the air exhaled but an instant before. In this particular room, which, by the way, is occupied by from 75 to 90 persons, the height of the operators' mouths and noses is from 4 feet 4 inches to 4 feet 8 inches. Therefore, the conditions here are figured to be even worse with downward ventilation than they would be if the breathing line were higher.

HEATING engineers are already beginning to speculate upon the effect of the growing use of turbine engines in plants that would naturally be expected to furnish exhaust steam for low pressure heating. In our April issue, we described an installation of a power and heating plant which included an equipment of turbine generators operated in connection with a system of exhaust steam heating. As the article stated, "a peculiar feature of the system is the use of exhaust steam for heating, taken from apparatus running under condensing conditions." As a matter of fact, this condenser has never been used, owing to the fact that no way was found to reduce the vacuum necessary to operate the turbines and at the same time permit steam to flow into the exhaust system or, on the other hand, to raise the vacuum of the exhaust system so as to overcome the very much greater vacuum in the condenser. As one engineer expressed it, "it is like having a big man trying to pull you out of one door and a small boy trying to pull you out of another. You will come pretty near going with the big man."

THIS issue goes to press as the convention of the National Association of Master Steam and Hot Water Fitters is in progress. President Gormly's administration has been a notable one and his reelection, as the head of the organization, would be not only a fitting acknowledgment of his splendid record but an assurance of the continued rapid development of the association and of its work.

The History of the Steam Loop

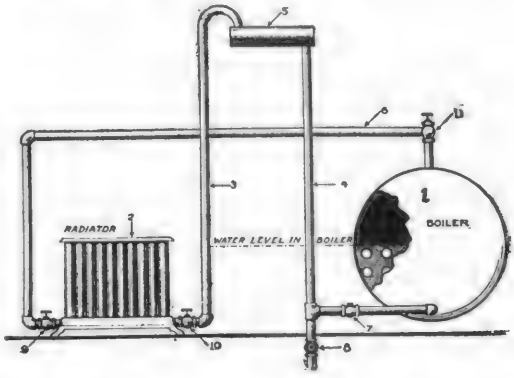
The development of the steam loop and its logical sequel, the steam trap, is told in a most interesting manner by Mr. James H. Blessing, of Albany, N. Y., whose claim, as the inventor of these devices, is well established. Mr. Blessing first refers to the style of steam loop that was brought to the attention of the public about 1890. In the loop shown in the illustration, 1 is the boiler; 2, the radiator; 3, the drip pipe from the radiator; 4, the return leg; 5, a short piece of pipe larger than the receiving or discharging leg, which forms the receiver or separator; 6, the main steam pipe for supplying the system; 7, the check valve opening towards the boiler to prevent the water returning to the system; 8 and 9, hand valves. The operation of the loop is described as follows:

We first open steam hand-valve 9 to admit steam into the radiator, then open steam hand-valve 8 that opens to the atmosphere and the steam entering the radiator will displace the air and water from the radiator up through the drip pipe 3 into the top side of the large pipe 5, and so on down through the discharging leg 4 that leads from the bottom of the large pipe 5 and so on through the hand-valve 8 to the atmosphere. When the air and first water have been removed from the system, close the hand-valve 8 and after the discharging leg of the loop has become nearly full of the water of condensation, the circulation will continue through the check valve 7 into the boiler. This circulation will continue so long as there is no air or an unusual flood of water, for when this happens, pipe 3 will fill solid with water. Under these conditions pipes 3 and 4 (the two legs of the loop) are equal, one balancing the other, and the circulation stops until the equilibrium is displaced by blowing through, as has been before described.

FIRST USE OF RETURN STEAM TRAP

Mr. Blessing then goes on to relate the manner in which he conceived the idea of the return steam trap. At that time, 1870, Mr. Blessing was in charge of the furnace and machine works of Townsend & Jackson, in Albany. In making some changes in the heating system, he arranged to use exhaust steam for heating the foundry and part of the upper floors and to heat offices, machine and pattern shops with direct steam taken from a boiler to be specially installed for that purpose.

"I intended," he says, "that the boiler should be set in a pit so that the water of condensation from the heating system of the lower floors would graviate into it. After having settled on this plan, believing it to be all right, I arranged with a contractor to remove as much as possible of the old heating system and replace it in the new works and to furnish all the extra pipe and fittings necessary to complete the system as I had planned it. After arranging with the contractor I paid very little attention to the matter, as we had over a hundred men employed in the different shops and my time and attention were fully occupied with the details of the business and the removal of the works. Therefore, I did not discover the gross error I had made until after nearly all the work was done, with the exception of the setting of the boiler. You can imagine my position, after explaining to my employers what a simple and effective plan I had devised for the return of the water of condensation back to the boiler, when I learned how impracticable it was to place the boiler low enough to have the water from the lower floors gravitate into it owing to the fact that each tide caused the level of the water in the river



TYPE OF STEAM LOOP IN USE IN 1890

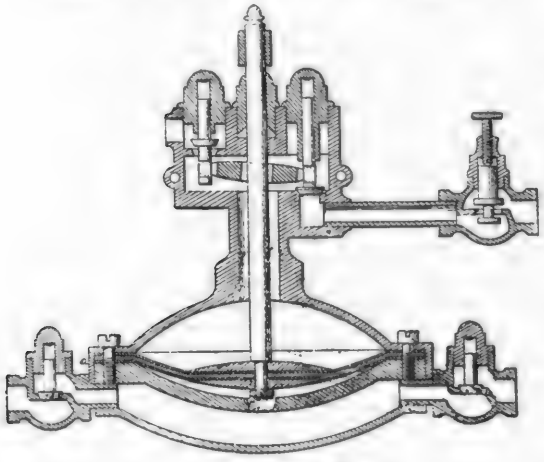
to rise higher than the fire box of the boiler. In order to overcome this condition it would be necessary to set the boiler in a tank anchored to prevent its floating. This would have been very expensive and under the circumstances impossible.

"After having discovered the character of the problem that confronted me, my first thought was to secure a trap that would return the water of condensation to the boiler without the aid of pumps. After making a thorough inquiry, I failed to learn of any such device.

"In an effort to solve the problem presented, my mind turned naturally to the thought of returning the water of condensation to the boiler by gravity, and my first experiments were all in that direction. My first return steam traps, invented during the year 1871, were placed above the water level in the boiler, the steam being taken from the steam space of the boiler and acting upon the upper

side of a diaphragm contained within the trap and intended for equalizing the pressures. This diaphragm acted simply as a dividing wall between the water on the one side and the steam on the other. The steam used for each discharge of water from the trap was, as in the case of a steam pump, exhausted to the atmosphere.

"Although the diaphragm trap was successful in its operation, yet it failed to



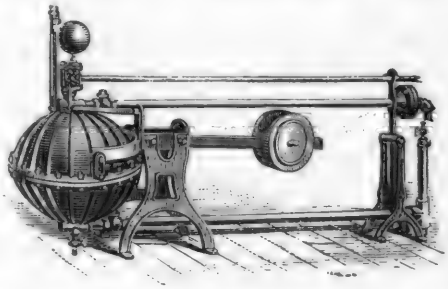
DIAPHRAGM TRAP
One of the Early Types of Return Steam Traps

return all the water and did not make up for the error I had made.

"In my experiments with the diaphragm trap several interesting facts came to light. Among other things, I discovered that the inlet pipe for conveying the water of condensation to the trap receiver from the coils contained steam and water, for, after the first condensation, due to the extra amount of steam condensed when steam was first let into the heating apparatus, was worked off by a few rapid discharges of the trap, it would require several minutes to collect water enough to again fill the trap. While this was filling up one could hear the inlet check valve on the inlet pipe rattling on its seat, caused by the water and steam passing through it. As a result of this observation and the experiments I had been making, it occurred to me that after all, the coils and radiators were only a part of the direct steam pipe that conveyed the steam from the boiler through them and finally terminated in the small pipes used for collecting the water of condensation.

"If this smaller return pipe were connected, so I reasoned, to the top of a vessel of proper size placed a certain distance above the water level of the boiler, the water and steam would pass over into such receiver, the water falling to the bottom and separating itself from the steam. The steam pressure in the receiving vessel would be about the same as the pressure in the system at its farthest point from the boiler. If this pressure were near enough to that in the boiler and the receiver were placed at a height sufficient above the water level in the boiler so that the solid water column would make up for the difference in the pressures, the water would gravitate back into the boiler through a return pipe extending from the bottom of the receiver. With this understanding of the conditions, I prepared a spherical vessel twelve inches in diameter as the receiver to be used in the system with which I was experimenting. I believed that a receiver of the size mentioned would be ample for the purpose, as the capacity was less than one gallon per minute. The receiver was placed on the floor above the boiler where the coils were situated and about nine feet above the water level in the boiler. After the receiver was connected up and steam turned on and the first water and air removed by blowing to the atmosphere, circulation began and was perfectly maintained. This, I believe, was the first steam loop ever made to return the water of condensation from a steam system situated below the water level of the boiler whence the water issued in the form of steam, all without in any way opening to the atmosphere.

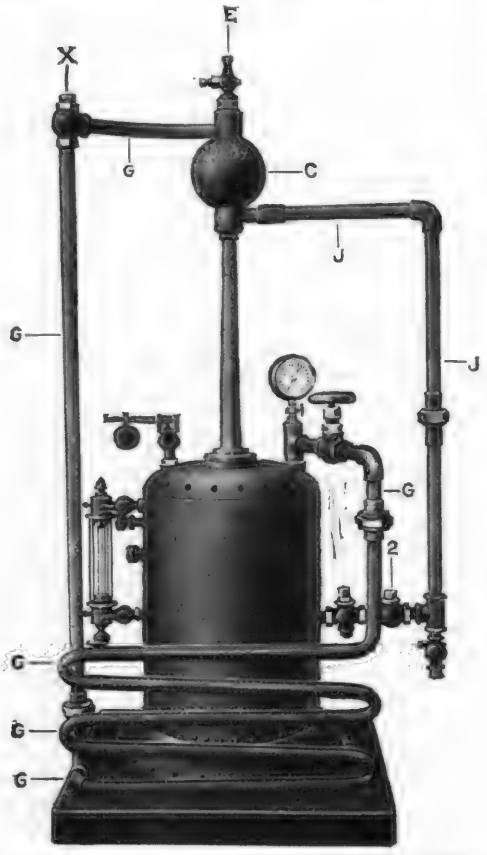
"After the steam loop had been in successful operation for some time in the Townsend & Jackson works I thought I would test it in another place. Accordingly, I selected the plant of Messrs. Weed & Parsons, printers, of Albany, where a modern heating system, using steam direct from the boiler, had just been installed. On investigation, I found



ALBANY GRAVITY RETURN STEAM TRAP
AS ORIGINALLY CONSTRUCTED

a place about ten feet above the water level in the boiler where the receiver could be placed. After getting the system connected up and making several attempts to start a circulation, I met only with failure. I next concluded to try the steam pressures and found a difference of about eight pounds between that of the boiler and the coils. This explained to me the reason for the failure to get up a circulation, for it would require for the height of the return column of water about twenty-four feet, or over twice the space available. Owing to the conditions

under which the system was installed I could not get a place sufficiently high for the receiver and could not without great expense enlarge the main steam supply pipe so as to make the pressures more nearly equal. I then made a change by taking the receiver and suspending it on one end of a counterbalanced lever and added a steam valve for admitting steam direct from the boiler into the top of the receiver for the purpose of equalizing the pressure with that in the boiler. This steam valve was caused to open and close automatically by the rising and falling of the receiver. In the form here shown in the cut this trap was known as the Albany Gravity Return Steam Trap."



COURT MODEL OF STEAM HEATING APPARATUS WITH STEAM LOOP ATTACHED

Mr. Blessing adds that many thousands of these traps are working at the present time and that many steam users still prefer them to traps of more modern construction. On this device, Mr. Blessing received letters patent, dated February 13, 1872; reissued August 26, 1873. The first claim in the reissued patent fully covers the device known as the "steam loop," of which the engineering world heard much a few years ago.

Mr. Blessing gives an interesting review of the legal actions instituted by him against alleged infringers of his trap, the most noted one being that brought against Baker, Smith & Company, New York. In this suit, a model steam heating apparatus, containing the steam loop, was set up in court for the purpose of disproving the assertion of the opposing counsel that water of condensation, in coils located below the water level, in a boiler, could not be returned to the same boiler whence it issued in the form of steam by the device as shown and described in the first claim of Mr. Blessing's patent.

This apparatus was designed to operate as follows:

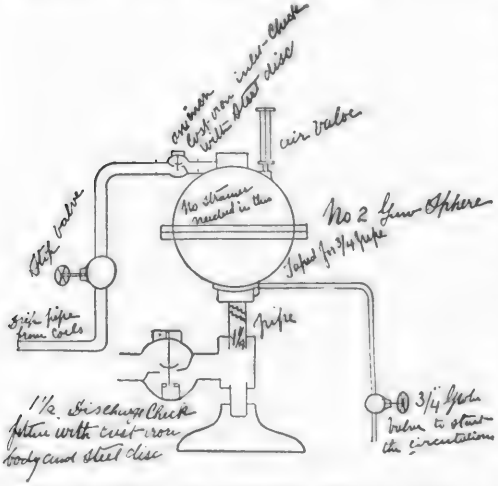
"A receiving and discharging vessel, *C*, communicating with a steam boiler by means of a steam pipe, *G*, and inlet check-valve, *X*, and with the same boiler by means of an outlet pipe, *J*, and valve, 2, and so arranged between or in respect to the two valves, that the water is received and allowed to fall to the bottom of the vessel, and the steam following is not compelled to pass through the water—all for the purpose of automatically returning water of condensation to the said boiler from steam heaters, substantially as described." We also quote from the specification: "It follows, therefore, that my trap is not dependent in the main for its utility upon the automatic tripping device, but performs the operation of passing the water of condensation back into the boiler independently of the same after the first quantity of such water is disposed of. The automatic valve opening and closing device is a very important auxiliary to my trap; but I regard it as only a second feature of invention, whereby the circulation from and to the boiler, if under any circumstances it is stopped by an undue quantity of water of condensation passing into the vessel *C*, may be automatically and quickly restored by the bringing into action of the gravitating principle of the vessel *C*, and employing the direct pressure of the steam from the boiler for expelling the water from said vessel, and then restoring the circulation by suddenly condensing the expelling steam and creating a partial vacuum in the vessel."

Steam was generated in the boiler in court by means of a gas burner, and when the pressure reached five pounds, the steam was let into the coil, a small air valve, *E*, on the top of the spherical receiver was opened to allow the escape of air and then closed. It was found that the circulation had commenced, and it continued for several hours, during which time the boiler pressure was made to vary from 1 to 15 pounds, in order fully to test the circulation. The test showed no variation in the circulation, which continued uninterruptedly through all the variations in the steam pressure. After this practical demonstration, in court, a litigation with Baker, Smith & Company virtually ended. The model still remains the property of

the Albany Steam Trap Company, and may be seen to-day at the firm's office in Albany.

For a special application of the steam loop, patented in 1872, by Mr. Blessing, a new patent was issued to him in 1883. The cut here shown was taken from the patent papers and is a very good representation of the device.

The cut shows a boiler and system of pipes and radiators, a part of the system being above the water level in the boiler and a part below. The water of condensation from the system above the water level of the boiler is arranged so as to gravitate back into the boiler. The other part of the system is on the same level with the boiler, the water being returned to the boiler by means of the device shown in the cut of the model on page 24, covered in the patent reissued in 1873, the only exception being that instead of blowing out the first water of condensation to start the circulation, an effort is made to save all the water condensed. To this end, it will be noticed, a direct steam pipe is taken from the main steam supply pipe and connected with the top of a spherical receiver. The supply pipe connected with the spherical receiver has attached to it a stop-valve, *G*, operated by hand a few times until the first water of condensation is removed from the radiators and the circulation established, after which the stop valve, *G*, may be closed and the circulation will continue as long as the steam pressure in the system is kept up.

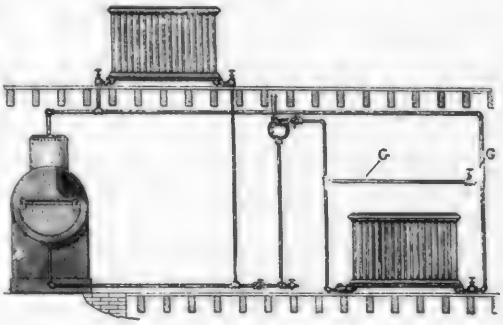


PEN SKETCH OF RETURN STEAM TRAP WITHOUT EQUALIZING VALVE

Mr. Blessing also describes a return steam trap, manufactured by him, without an equalizing valve which was placed in a system to return the water of condensation to the boiler. The rough pen sketch shown herewith was prepared at the time by Mr. Blessing with indications on it for piping the system into which the trap was to be introduced.

This trap was placed in the plant of the Jackson Powder Company, McCainsville, N. J., in 1882. In a letter which accompanied the trap, Mr. Blessing said:

"We do not think it necessary to send anyone to connect this trap, it being so simple. We will send it all screwed together—that is, the base connected to the sphere by a short nipple. You can simply unscrew the sphere and insert a piece of



TYPICAL INSTALLATION OF GRAVITY AND LOOP STEAM HEATING SYSTEM

pipe of sufficient length to raise the sphere about ten feet above the water level in the No. 1 pan, and connect the discharging check to the feed pipe now entering the pan. We do not know what size the feed pipe is, but we presume it is large enough. You will notice an outlet in the discharge pipe just below the sphere. You will connect a pipe with this outlet and run it down where it will be handy to get at, and attach a stop valve at the lower end. This valve is to be used for starting the circulation. You may connect the drip pipes from pans Nos. 2 and 3 to the inlet pipe leading up to the inlet check on the upper side of the sphere. We would also advise you to place in this pipe a stop valve. The air valve sent with the trap is to screw into the opening you will find tapped into the top side of the sphere, and so adjust it that there will be a very slight leak.

"To start the trap in operation: When you have, say, ten or twenty pounds pressure, open the stop valve in the pipe leading up to the top of the trap. Then open the stop valve in the starting pipe, and in a few seconds the steam will have blown out the air. Steam and water will follow, then close the valve. So long as there is any steam pressure (it will make no difference whether it is one or two hundred pounds) it will continue to circulate. It is possible that the apparatus may start in operation without opening the starting valve, as the air may escape through the automatic air valve, and the circulation be started without opening to the atmosphere. We will add, if you are correct about there being only about one pound difference in your system, the trap is sure to operate on the ten-foot height above the water level. We will also say, for

fear that some of your people might be curious enough to learn what there is in the inside of the sphere: There is simply nothing, and you will have nothing to keep in repair.

"Yours truly,

"JAMES H. BLESSING, Sec."

In explaining the reason why the device mentioned in the letter was sent instead of the regular trap, Mr. Blessing says that the superintendent of the Powder Company desired to use steam at 150 pounds pressure. Traps at that time were not constructed for such high pressures. The steam system on which the device was to be used was a simple one, consisting of two drying pans containing about 170 square feet of radiating surface. It was believed to be a favorable place for the installation of such an apparatus.

Discussing the difference between the steam loop and the return steam trap, Mr. Blessing says:

"The mode of returning the water is the same in both. Without opening to the atmosphere and without any loss, both return the water of condensation to the boiler whence it issued in the form of steam and at a temperature only a few degrees less than that of the steam itself.

"It may be said that the only difference between the two methods is in the way in which the equalizing of the pressures for returning the water is accomplished. In the case of the 'steam loop,' the height of the returning water column must be great enough to make up for any difference in pressure there may be between the boiler and its steam system, *e. g.:* If the difference in the steam pressure between a certain boiler and its system of distribution is ten pounds, the height of the return water column in the steam loop would need to be from twenty-five to forty feet above the water level in the boiler in order to maintain a circulation. With the return trap the difference in pressure is equalized, not by the length of a return water column, but by means of steam taken taken direct from the boiler. It is not found necessary, therefore, to place the trap so high above the water level in the boiler. In the case of the Albany Return Steam Trap, thirty inches above the water level in the boiler will be found to answer for the return of the water of condensation. The equalizing valve attached to the top of the trap must be so arranged that it will open and close automatically every time the trap fills and discharges. This equalizing valve, operated automatically, is the main difference between the steam loop and the Albany Return Steam Trap.

"It may be argued that the addition of the equalizing valve made the steam trap a more complicated device. There might be some weight to this objection if one failed to consider the superior advantages to be gained by its use. If an Albany Return Steam Trap be placed at the same height above the water level in a boiler as the 'steam loop,' the trap will perform the work in the same manner as the loop without the aid of the equalizing valve. The Albany Return Steam Trap will therefore do all that the 'steam loop' will accomplish, and also much more, as I shall attempt to show. If at any time the circulation should stop, say from an overflow of water or an extra accumulation of air, the circulation will quickly be restored through the action of the equalizing valve. Another important advantage of the Albany Return Steam Trap over the 'steam loop' is. that the trap will work perfectly on a much lower steam pressure in the system.

"Perhaps one of the most important advantages of the return steam trap over the 'steam loop' may be shown by an example. In this case it would be impossible to accomplish the result with the 'steam loop.' Suppose a steam system supplied by a boiler carrying 100 pounds pressure, a part of the system being used for heating purposes with steam at a pressure of from five to ten pounds, and the rest of the system used for a dry room with steam at the full boiler pressure of 100 pounds, or as near to that figure as practicable. All the water of condensation from both parts of the system, notwithstanding the great difference in pressures, can be returned to the boiler without opening in any way to the atmosphere, with the aid of one Albany Return Steam Trap. Therefore, I do not hesitate to say that the Albany Return Steam Trap will do all that can be done with the 'steam loop' and also what the loop absolutely fails to accomplish.

"The importance of returning the water of condensation to the boiler under pressure has not been so well considered as it deserves. For illustration, take the water from steam jacketed cylinders and reheaters, such as are used in connection with high-grade expansion engines where the steam pressure is from 150 to 200 pounds, and the sensible temperature from 366 degrees to 377 degrees F. The water of condensation from these cylinders or re-heaters is about the same temperature as the steam. If this water were allowed to escape to the atmosphere it would instantly reduce itself to 212 degrees F., and in nine cases out of ten would not be returned to the boiler even at that temperature.

"If the water were returned to the boiler by a pump it would be liable to a still lower reduction, and might reach the boiler at a temperature of about 150 degrees F. Even if it were returned by a pump at 212 degrees F., the Albany Return Steam Trap would be more efficacious to the extent of saving from 154 to 165 heat units on every pound of water returned. If the feed water were restored by the pump at 150 degrees F., the saving in favor of the trap would be from 216 to 227 heat

units for each pound of water returned. The importance of returning the water of condensation to the boiler by means of the trap is, therefore, self-evident. Yet this is not all. In the case of the steam trap there is no possible chance for any steam to escape from any part of the system when all the parts are properly connected, as the steam used to operate the trap is taken directly from the boiler through a continuous section of pipe and the water of condensation reaches the boiler, all without in any way opening to the atmosphere."

A New Liquid Measuring Apparatus*

By George B. Wilcox, Saginaw, Mich.

The liquid measuring apparatus herein described was originally designed to automatically measure brine flowing from a salt well into a salt works. After about a year's satisfactory operation in that capacity, tanks of the same type, but modified in detail, were designed and set up as a permanent part of a boiler room equipment, to automatically measure and record the amount of feed water supplied to boilers. Apparatus of this kind designed as a portable testing device has proven of the greatest service on evaporative tests, for it does away with the uncertainties and hard work of weighing by the usual tank and scale method.

It may be more correctly termed a weighing rather than a metering device, as will appear later, and it will be so described.

NOTABLE FEATURES OF THE DEVICE

Notable features of the device are: elimination of constant errors of graduation, present in many water meters. Its operation is not appreciably affected by air in the liquid, or by changes in temperature, head or quantity of discharge of the liquid being weighed, and clogging by dirt is not liable to occur.

These advantages are due to the fact that no discharge valve is used in the weighing tank, avoiding the possibility of leakage, and to the reliability of the counterbalancing weight employed, namely, a liquid column of fixed weight.

The apparatus accommodates itself to an irregular supply and delivers intermittant charges or units of uniform weight.

It consists of two tanks placed one above the other. The upper or receiving tank stores the liquid and automatically delivers it at intervals as required to the lower tank where it is weighed. The lower or weighing tank delivers the unit charge intermittently, the intervals between deliveries varying with the rate of supply.

GENERAL OPERATION OF APPARATUS

The liquid accumulates in the upper tank until it overflows a standpipe located in the upper tank, and spills into the tank below. After a small quantity of overflow has accumulated in the lower tank, the stored liquid in the upper tank is suddenly emptied into the lower tank. Further supply, instead of accumulating in the upper tank, as before, flows along its bottom and drops into the lower.

The liquid in the lower tank automatically discharges when a unit charge has accumulated, and simultaneously the outlet from the upper tank to the lower tank closes, preventing entrance of liquid into the lower tank while the weighed charge is escaping from it.

The apparatus is shown in the accompanying illustrations, with the exception of Fig. 1, which showed the apparatus in use.

FIG. 2. VIEW OF NEW LIQUID MEASURING APPARATUS

Fig. 2 is from a photograph of the same apparatus, showing the trap in the discharge pipe and the "trip" or counterbalancing liquid column by which the unit charge is automatically weighed and discharged.

Fig. 3 is a vertical section of the apparatus adapted for measuring hot water.

Fig. 4 is a detail of the upper tank adapted for measuring cold water.

Fig. 5 is a modified form of trip.

Referring to Figs. 3 and 4 (A) is the upper or receiving tank, and (B) the lower or weighing tank.

*Paper read at the Chattanooga (Tenn.) meeting of the American Society of Mechanical Engineers, May 1-4, 1906.

(1) Is the inlet for liquid to be weighed, having a baffle plate (1*a*) to prevent splashing.

(2) Is the valve inlet to the weighing tank. When seated (2) becomes an overflow pipe through which liquid may spill into the weighing tank. When raised, it permits liquid to flow direct into the weighing tank.

(3) [Fig. 4] is a vent pipe.

(4) Is a cone to guide the liquid gently to the weighing tank just previous to delivery of the unit charge.

(5) Is a large U-shaped water-sealed discharge pipe, its upper end (5*a*) projecting through the bottom of the tank (*B*).

(6) Is a vertically movable bell float that envelops the upper end of the pipe (5*a*). The float and pipe together form a siphon through which the weighed charge escapes when dumping. Float (6) carries a rod (6*a*), the upper end of which engages and opens the inlet valve (2) when the float (6) rises. The stored liquid in the upper tank then drops quickly into the weighing tank.

(7) Is a manometer or "trip" by which the charge is automatically weighed and released from tank (*B*).

(8) Is a float-actuated counter that registers the number of charges weighed.

(9) Is a gauge glass.

(*C*), Comprising the bell float (6) and the upper part of discharge pipe (5) is an air chamber. This chamber acts as an air cushion while the unit charge is being collected, releasing the unit charge when the air is released by the automatic operation of the trip (7).

When hot water is being weighed two additional devices are employed to prevent steam or vapor entering chamber (*C*) and thereby impairing the accuracy of the apparatus, the first of which devices is an inverted cup (10) carried by the overflow pipe of inlet valve (2). The lower end of the cup (10) is water sealed when the lower tank discharges, thereby preventing hot vapor being drawn from the upper into the lower tank.

(11) Is a pipe connecting the weighing tank and the outside air.

The operation is as follows: Assuming the apparatus to be primed, which consists in filling the U-pipe and the trip to their normal levels, liquid from the inlet enters the upper tank, its level rising to the top of the overflow pipe (2*a*) carried by the valve (2). Overflowing and passing through the open spider of the valve it enters the lower tank. Bell float (6) in the lower tank rises as the charge accumulates, until the shoulder on float rod (6*a*) engages and lifts valve (2).. Thereupon the stored liquid in the upper tank drops quickly into the lower tank, filling it nearly to the discharge level (*x*). Liquid from pipe (1) thenceforth flows freely along the bottom of the emptied upper tank, gliding down the cone (4) and quietly adding to the level in the lower tank. Soon the level reaches the height (*x*) for which the tripping device is ad-

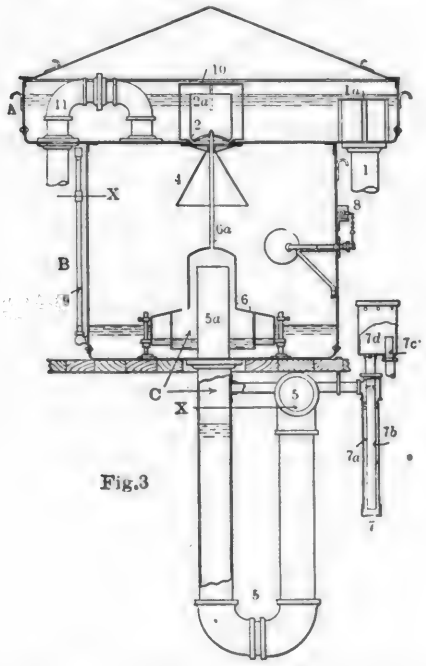


Fig.3

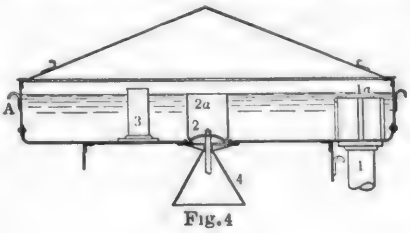


Fig.4

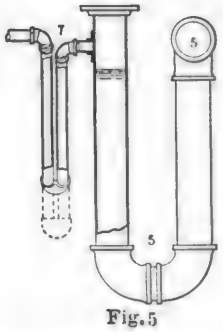


Fig.5

FIG 3. VERTICAL SECTION OF APPARATUS ADAPTED FOR MEASURING HOT WATER
FIG. 4. DETAIL OF UPPER TANK ADAPTED FOR MEASURING COLD WATER
FIG. 5. MODIFIED FORM OF DRIP

justed and discharge from the lower tank occurs through the automatic operation of the trip (7).

The effective head in the manometer or trip (7) exactly adjusts itself to and balances this head of liquid accumulating in the lower tank, increasing as the head in the lower tank increases. The balance is maintained through the medium of the air cushion in chamber (*C*). Releasing the air cushion releases the charge in the lower tank.

The function of trip (7) is to suddenly vent the air cushion when the head in the tank equals the maximum head that can be maintained in the trip.

When the level in pipe (7*a*) of the trip sinks to the bottom of the pipe (7*b*), Fig. 3, the liquid head in the tank is delicately balanced by a liquid column, exactly equal in height to the vertical distance from the botom of pipe (7*b*) to the top of pipe (7*c*). The slightest addition of head in weighing tank (*B*) spills a few drops from (7*c*) and destroys the hydrostatic balance. Instantly the air cushion in chamber (*C*) shoots the liquid from (7*b*) and escapes with it through (7*c*).

Deprived of buoyancy, the bell float (6) suddenly drops, allowing he valve (2) to seat, thereby preventing inflow to the weighing tank while the weighed unit discharges. The unit charge (*B*) swiftly siphons out through the bell (6) and pipe (5*a*), escaping through pipe (5). When the level in the weighing tank has sunk to the rim of bell (6) air enters the bell float, the siphon breaks, and discharge ceases leaving the U-bend of the discharge pipe and the trip full of liquid and the level in the measuring tank at its zero point as in the initial condition. An interval then ensues during which the liquid in the tripping siphon and discharge pipe and the residue in the measuring tank come to rest at normal or zero level, while the next charge begins to accumulate in the upper tank. The process then repeats itself.

In the form of trip shown in Fig. 5, the trip is a U-pipe (7*a*) (7*b*) capable of swinging around its point of attachment to the discharge pipe. Such adjustment in effect varies the maximum effective head of water column that the pipe may contain and thereby adjusts and controls the discharge level of the measuring tank. The apparatus can thereby be set to discharge any desired weight of unit charge within its capacity.

An installation was described in which an apparatus weighs feed water supplied to a battery of six 350 horse power Wickes Vertical Water Tube Boilers, generating steam to operate a 1,600 kilowatt generator with auxiliaries and pumps.

The average flow through the tank described was sixty-three thousand pounds of water per hour at a temperature close to the boiling point, fluctuating between 205 degrees and 210 degrees Fahr. It operates under a wide range of supply and delivery, and adapts itself to extraordinary fluctuations.

DIMENSIONS OF TANK

The dimensions of the tank were, in brief, as follows: The upper tank is 72 inches in diameter and 1 foot deep. The lower tank is 48 inches in diameter and 3½ feet deep. Height from floor to top of cover, 5½ feet. The discharge pipe projects below the floor 5½ feet.

Numerous trials under actual use as a feed-water weigher showed a maximum error, after four months' constant service, of less than ¼ of one per cent.

A temperature fluctuation of ten degrees causes no appreciable error in operation. The error that would naturally be introduced by increase of volume incident to increased temperature is small, and even this small error appears in practice to be offset by expansion or contraction of the weighing tank as the temperature rises or falls.

CORRESPONDENCE

Upward and Downward Ventilation

Editor HEATING AND VENTILATING MAGAZINE:

In your issue of April appeared my letter, under the caption of "Upward and Downward Ventilation." Before I had seen the letter in print my son consulted me on the matter of school ventilation, and he informed me that the impression he had received from my letter was that schools should have nothing but upward ventilation.

I certainly did not intend to convey this idea in regard to schoolrooms as ordinarily constructed. The condition of buildings as they exist, and the conditions within schoolrooms, will scarcely permit of top ventilation to the exclusion of bottom ventilation, and all things taken into account I consider that our usual method of admitting the air to the schoolroom, seven or eight feet above the floor, and taking it out at both the bottom and the top of the room, is the best thing that can be done.

In the matter of auditoriums (meaning assembly rooms, theaters, and other large places in which a great number of people are closely packed), my experience certainly points to upward ventilation. There is no objection to taking air out at the floor-line as well; provided it can be properly and conveniently done.

In the schoolroom air must be admitted above the head-line, for the simple reason that it is the only place in an ordinary schoolroom where it can be

admitted in the quantities required without causing inconvenience.

In the matter of drawing the foul air from a schoolroom, my position is probably made plain in the following quotation from my letter in your April issue: "As an engineer, I do not dare to omit it (meaning the top register), and would not omit it except under special orders from my client, and then I would omit it under protest."

I did not have it in my mind that the bottom register should be omitted under any consideration. The idea that I desired to convey was that for an ordinary schoolroom the air should come in seven or eight feet above the floor, and that provision should be made for taking the air out at both the top and the bottom. The bottom register or opening would be so constructed it could not be closed, and that the top register would be so constructed it could be closed.

When I spoke of giving the occupant of a schoolroom three options I had in mind both top and bottom vent registers, meaning that those who wanted top ventilation could close the bottom register and take it altogether at the top; that those who wanted bottom ventilation could close the top register and take it altogether at the bottom; and that those who wanted top and bottom ventilation could leave both registers open, or partly open, and take it as they pleased.

I believe, therefore, that the use of a top and a bottom outlet in a schoolroom is the only practical thing for the engineer to provide.

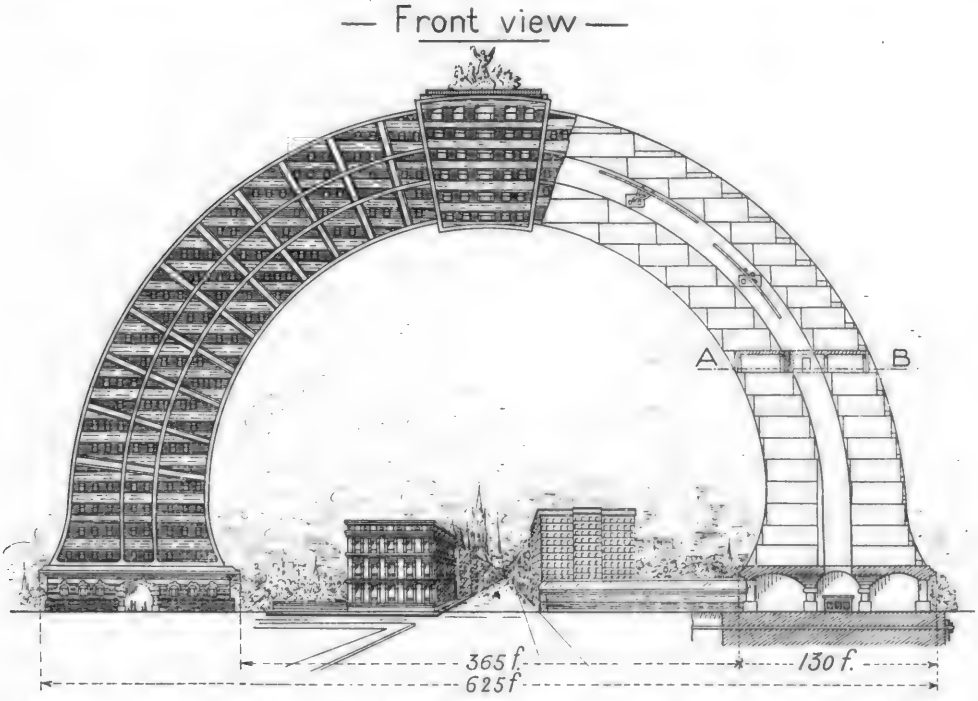
Very truly yours,
WILLIAM J. BALDWIN.

New York, June, 1906.

Ventilation for High Buildings

A Belgium engineer has sent us a design for a tall building, calculated, among other things, to secure thorough ventilation by natural means, as well as offering shock-resisting qualities against earthquakes or similar disturbances. In fact, the inventor, Jules Gerneart, mentions the disaster at San Francisco as a reason for bringing forward his new type of building. In the course of his long residence in the United States in 1901, he says that he noticed the disadvantages shown in the construction of the high buildings of our great cities. He found, among other things, that the lighting and ventilation of the rooms in the central parts of high buildings were often defective and that the structures could, in many cases, be given what he terms a more handsome appearance and their stability better secured.

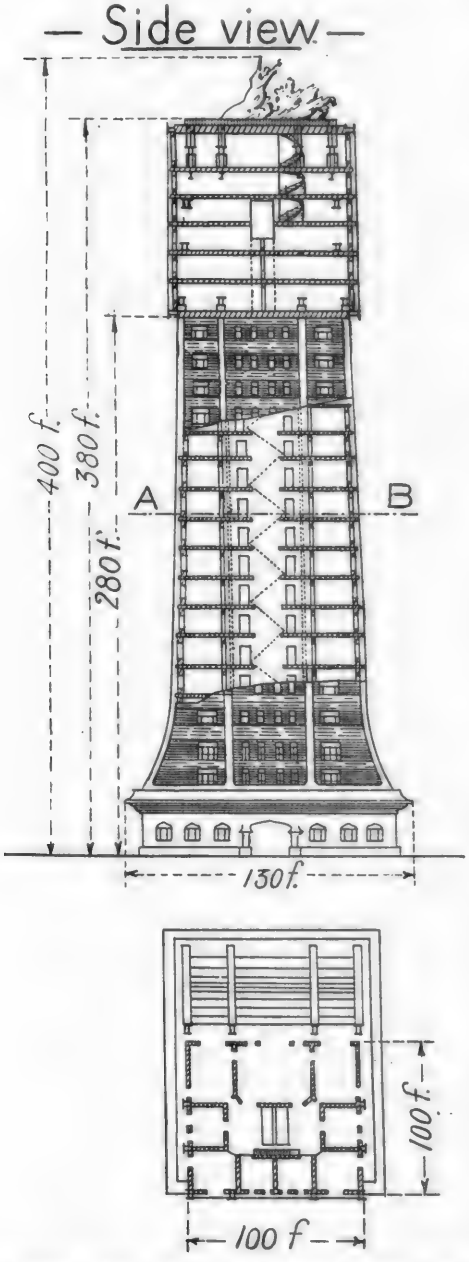
The type of building illustrated herewith is the outcome of his observations, and we are advised that he has filed a patent application on his design at the Patent Office in Washington.



PROPOSED TYPE OF TALL BUILDING, DESIGNED TO SECURE AMPLE LIGHT AND VENTILATION AND TO WITHSTAND EARTHQUAKES

Compulsory Metric Legislation Defeated

The advocates of the metric system in this country, whose efforts to make the metric system compulsory have been reported from time to time in our columns, have now met with a check that will discourage, for the present at least, any further action on their part. After succeeding in having introduced in the House of Representatives a bill known as the Littauer Compulsory Metric System Bill, intended to make the French system of weights and measures compulsory in all government transactions, the bill was referred to the House Coinage Committee, where is was "killed" by a vote of 8 to 4 on April 27 last.



SIDE VIEW AND HORIZONTAL SECTION BY A-B OF PROPOSED TALL BUILDING.

Questions on Standard Sizes of Steam Mains and Returns

The following list of questions has been prepared by the committee appointed at the last meeting of the American Society of Heating and Ventilating Engineers to collect data on standard sizes of low pressure steam mains and returns and is being distributed to the trade. In sending out the list the committee says: "We think there may be a variance of opinion as to the proper size of steam mains for a given amount of radiation where the run is long; but that it may be possible to adopt as a standard the amounts generally in use at the present time for the average installation where the run is short or not over 100 feet.

"Thus, although it may not be advisable in all plants to put as much radiation on a pipe as given in the standard, yet we can adopt a maximum amount and agree that it is never advisable to exceed it.

"We would like you to answer the questions as fully and as much in detail as possible and add any information you may have on the subject."

THE QUESTIONS

1. Do you use standard sizes of radiator connections for low pressure steam work, as published in the manufacturers' catalogues?

2. If your practice differs, please indicate it on the accompanying tables.

3. Please state whether your practice differs from Table II of the maximum amounts of direct radiation permissible upon pipes of the corresponding sizes for low pressure steam work and give the amount which you use in your practice? What allowance do you make for extra long or crooked steam lines?

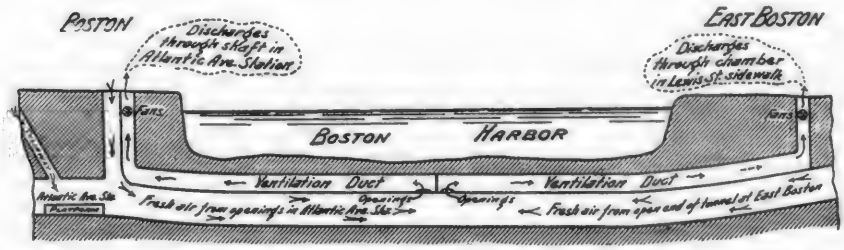
4. Do you consider that the adoption and use of steam and return mains would aid the heating engineer in the production of better results with steam heating apparatus?

TABLE II

Steam main.	Square feet of heating surface.	Dry return.	Wet return.
1 in. pipe.	40	¾ in.	¾ in.
1¼ in. pipe.	75	1 in.	¾ in.
1½ in. pipe.	125	1 in.	1 in.
2 in. pipe.	286	1¼ in.	1 in.
2½ in. pipe.	535	1½ in.	1 in.
3 in. pipe.	890	1½ in.	1 in.
3½ in. pipe.	1,360	2 in.	1 in.
4 in. pipe.	1,950	2 in.	1 in.
5 in. pipe.	3,600	2½ in.	1¼ in.
6 in. pipe.	5,900	3 in.	1½ in.
8 in. pipe.	12,700	4 in.	2 in.
10 in. pipe.	22,900	5 in.	2½ in.
12 in. pipe.	37,090	6 in.	3 in.
14 in. pipe.	55,300	7 in.	3½ in.
16 in. pipe.	78,300	8 in.	4 in.

5. Give any additional data of information that you may have in reference to the above subject. Respectfully,

J. A. Donnelly,
H. J. Barron,
F. G. McCann.



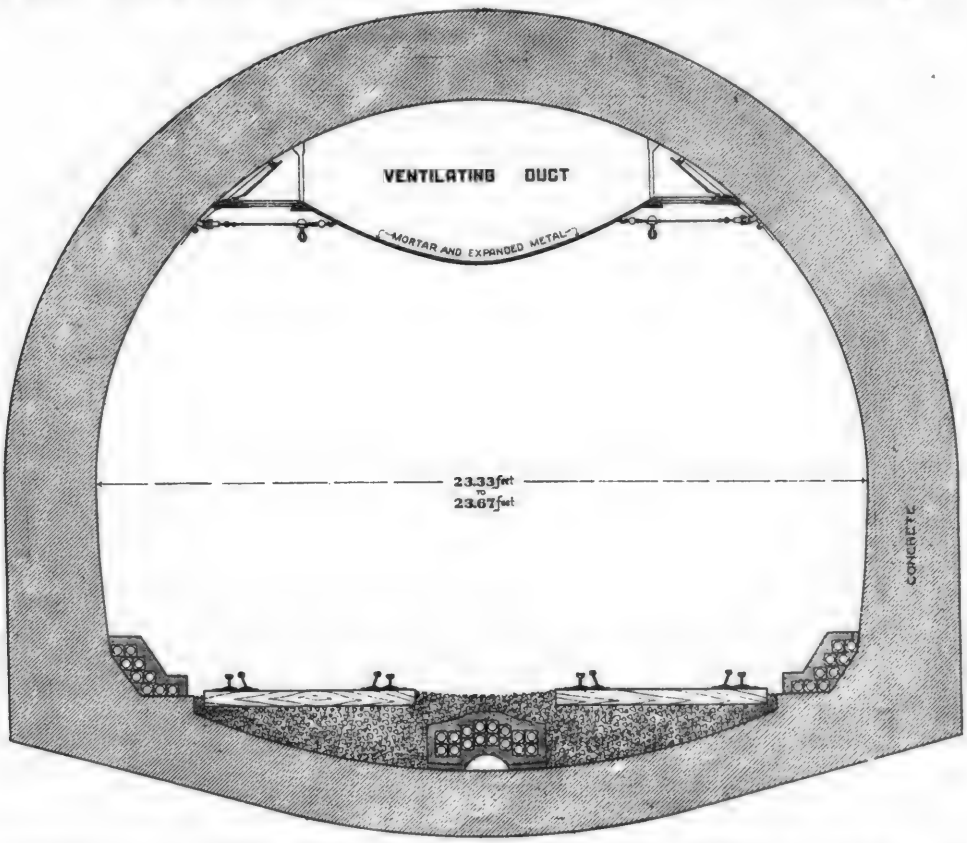
SECTION OF THE EAST BOSTON TUNNEL, SHOWING THE VENTILATION DUCTS

Cincinnati's Industrial Exposition

We have received the sumptuous prospectus of the Cincinnati Fall Festival and Industrial Exposition, which will be neld at Cincinnati, Ohio, August 28 to September 22, 1906. This is the fifth festival of the kind to be held in Cincinnati, and manufacturers throughout the United States are invited to send exhibits. The headquarters of the festival company are in the Union Trust Building, Cincinnati. Among the various exhibits for which provision has been made are electrical appliances, food products, live stock, machinery, furniture, automobiles, etc. The national government, as well as the State and municipal governments will be, as usual, among the exhibitors. The fêtes, which will be a feature of the festival, are being planned on a larger scale than ever before.

Subway Tunnel Ventilation

In connection with the exhaust system of ventilation being adopted for New York's Subway, described in our last issue, it is interesting to note the method by which the East Boston tunnel of that city's Subway is ventilated. The accompanying illustrations, published through the courtesy of the *Cement Age*, where they appeared in an article on concrete work by Mr. E. S. Larned, of Boston, showing the use of the exhaust system and the method of constructing the



CROSS-SECTION OF THE EAST BOSTON TUNNEL UNDER THE HARBOR, SHOWING THE METHOD OF VENTILATION

ducts. The East Boston tunnel, completed in 1904, is 1.4 miles long, approximately one mile of which is under the harbor.

The width of the tunnel is 23.5 feet. The top of the rail is 77.3 feet below mean water, and at the lowest point the foundation is 82.3 feet below this datum.

By separating the ventilating system into two sections it will be seen that the length of the discharge duct was approximately six-tenths of a mile in length.

Features of New York State's Ventilation Law

School Building Laws of New York and New Jersey is the title of a vest pocket booklet, published by the Fuller & Warren Company, Troy, N. Y., containing abstracts of the school building laws of New York and New Jersey which refer to heating, ventilation and sanitation. In addition to the extract of the New York law is a portion of a circular issued in May, 1904, by the State Education Department, signed by A. Edson Hall, Inspector, and approved by A. S. Draper, Commissioner of Education, calling attention to the State law as passed, with special reference to the following points:

Plans and Specifications. 1. The plans and specifications must be submitted in duplicate, the original set to be returned after the indorsement of approval, the duplicate to be retained on file at this department.

Heating and Lighting and Ventilation. 2. The plans and specifications must show in detail the ventilation, heating and lighting system of the building and must be accompanied by a guaranty from the contractor that the system of ventilation described will provide at least 30 cubic feet of air per minute for each pupil. It will be necessary to give the size of windows, distance from top of window to ceiling and number of panes in sash.

Size of Rooms. 3. At least 15 square feet of floor space and 200 cubic feet of air for each pupil to be accommodated in each study or recitation room must be provided. In this connection it will be necessary not only to state the size of the room (length, breadth and height), but also to give the number of individual desks to be placed in the room.

Exits. The plans and specifications must show clearly that the proper provision is made in all respects "to facilitate egress in case of fire or accident and to afford requisite and proper accommodations for public protection in such cases."

To minimize the number of changes and avoid unnecessary correspondence the following explanatory statements are offered:

Windows. The windows in all study rooms and recitation rooms should be so arranged that the main light will come from the pupil's left and the supplemental light from the rear. The windows should be grouped together as nearly as possible on the pupil's left so that the light may be massed, thereby furnishing a comparatively even distribution of light and minimizing areas of light and shadow.

The windows should extend as near to the ceiling as the principles of construction will admit and should be without transoms or unnecessary framework.

Any considerable areas on the side to the left of the pupils that is without window surfaces should be opposite to the space in front or in rear of the pupils' desks.

In this connection it might be added that the ratio of window surface to floor surface should be one to five. If the main light comes from the north or from a side of the building which is well shaded, the ratio should be one to four.

As far as possible the rooms and windows should be arranged that the aisles may run the long way of the room.

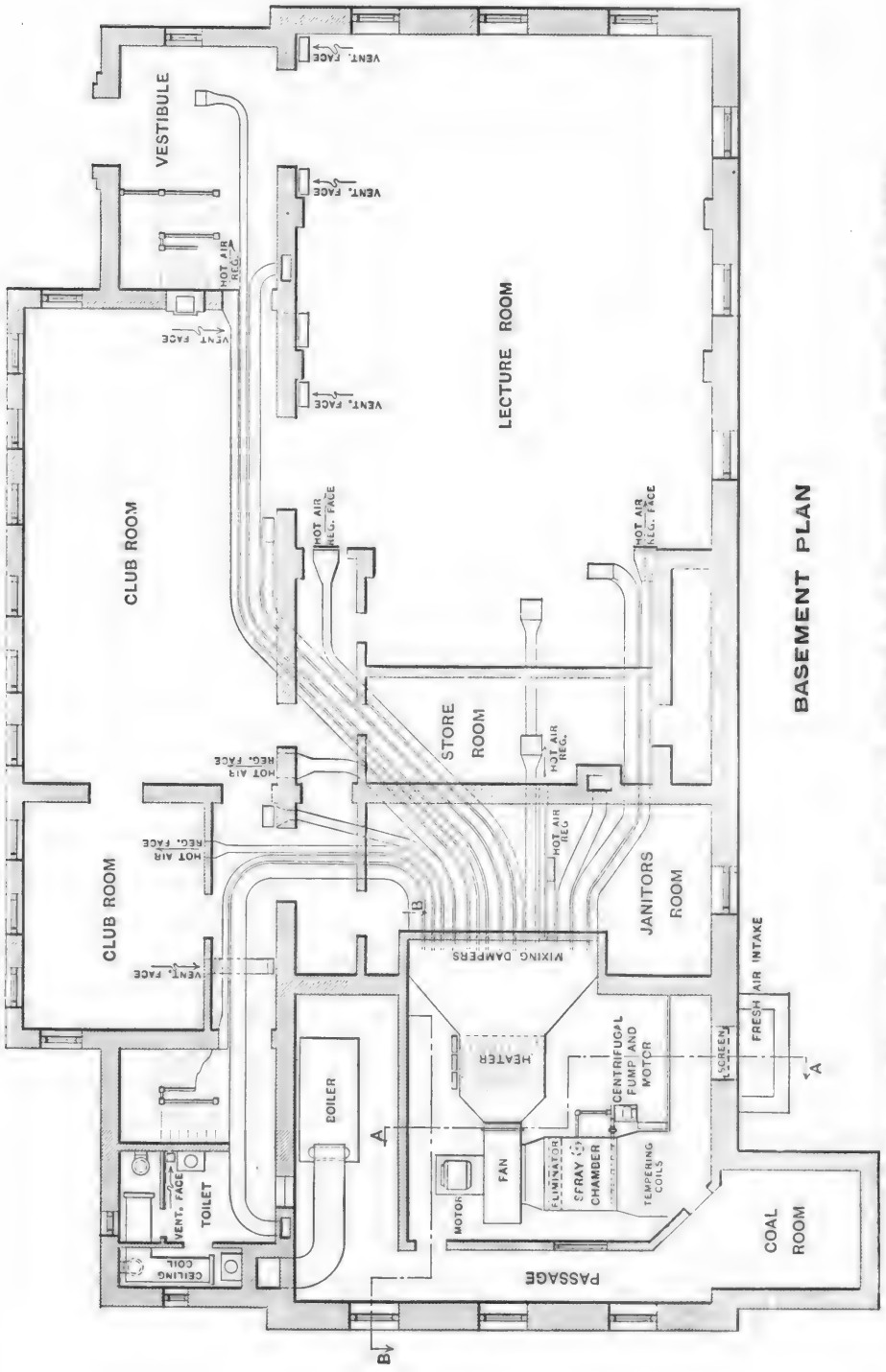
Cloak Rooms. Special cloakrooms should be provided which should be thoroughly heated and ventilated.

NEW DEVICES

Buffalo Air Washer and Humidifier

The accompanying cut illustrates a typical arrangement of the new air washing and moistening apparatus recently placed on the market by the Buffalo Forge Company, for use principally in connection with their fan system heating and ventilating apparatus.

A considerable amount of attention has been given in the medical journals and by architects and engineers, to the need of some compact form of apparatus to prevent the large amount of solid impurity from finding its way into buildings which are ventilated by this and other systems. Shafts extending through the roof of required size for the inlet of fresh air, are more often than not impracticable, and when air is taken at the street level and, as sometimes happens, through sidewalk openings, the amount of dust and filth which enters the flues and finds its way into the rooms is surprising. Cheese cloth screens, to be effective, must be frequently replaced, as they are quickly clogged up. The act of replacing shakes more or less of the dust loose, and as often as not, the screens are thrown to one side because the janitor finds it too much trouble to look after



TYPICAL INSTALLATION OF BUFFALO AIR WASHER AND HUMIDIFIER IN VENTILATING SYSTEM

them. Obviously, any arrangement to be effective, must be automatic, and this is a feature of the Buffalo air washer, which requires less space than screens of cheese cloth or coke filters, is self-cleaning, and by finely divided sprays removes, not part, but all of the solid matter in suspension.

This air washer consists of a system of closely spaced spray nozzles, galvanized iron or copper baffle plates, eliminators for removing the water in suspension, and the necessary casing and tank to make the apparatus air and water-tight, clean and economical in operation, and automatic so far as any attention is concerned, except starting up the circulating water for the sprays whenever the heating system is put in operation. Patented spray nozzles are used, which, instead of throwing the water in sheets, separate it into an impalpable mist and are so designed that they will not clog up. The water laden air impinges on zig-zag continuous plates which are constantly covered with a film of moisture.

By atomizing the water, the amount which is required is reduced to the lowest possible point, and as all the water returns to the settling tank it may be recirculated. The amount and arrangement of contact surfaces is such that the resistance to the flow of air is negligible and it is so compact that the whole apparatus takes up no more space than a bank of fan system heating coils. The baffle plates cleanse themselves, all the dirt passing to the settling chamber. City water pressure may be used for the sprays or when the water is recirculated, a small centrifugal pump supplies the necessary pressure. The same apparatus is used for cooling in summer.

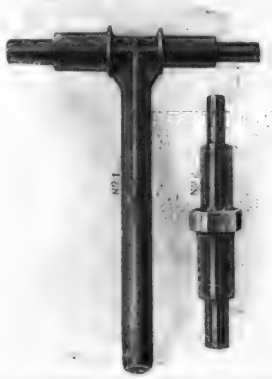
Expansion Tank Bracket

An expansion tank bracket that can be quickly adjusted to take in and hold all sizes of tanks from 10 to 16 inches in diameter has been placed on the market by the American Radiator Company and is now carried in stock at the firm's various branches. It will be welcomed by many steamfitters as an inexpensive and convenient device for supporting the expansion tank of a hot water heating outfit. The bracket can be put up in a few moment's time and gives a neat finish to that part of the plant. The appliance weighs about 5½ pounds and includes screws, tacked under the slide pieces. The price list for the bracket is $1.75, on which discounts are quoted to the trade.

A CONVENIENT EXPANSION TANK BRACKET

A New Spud Wrench

Two forms of improved spud wrenches are manufactured by the American Radiator Company and are illustrated herewith. These little tools are most convenient for connecting up union radiator valves on union elbows. Spud wrench No. 1 is used hand to hand and has an open hexagon on the end of the handle for addressing bolt nuts. Spud wrench No. 2 is used in connection with the Stillson wrench. The four sizes of fittings which can be adjusted by these single tools are 1½ inch, 1¼ inch, 1 inch and ¾inch. Wrench No. 1 is listed at 50 cents and No. 2 at 75 cents, on which discounts are quoted.



NEW TYPE OF SPUD WRENCH

Books Received

Modern Engineering Practice, 12 volumes, edited by Dr. F. W. Gunsaulus. Size of vol., 7x10 inches. Price, $60.00. Chicago, Ill.: American School of Correspondence.

The covering of a field so broad as that of modern engineering is a task almost limitless in its possibilities, yet the work undertaken by the American Correspondence School, of Chicago, and published in twelve volumes, under the title of "Modern Engineering Practice," not only admirably fulfils its purpose, but will prove a source of much interest to engineers generally.

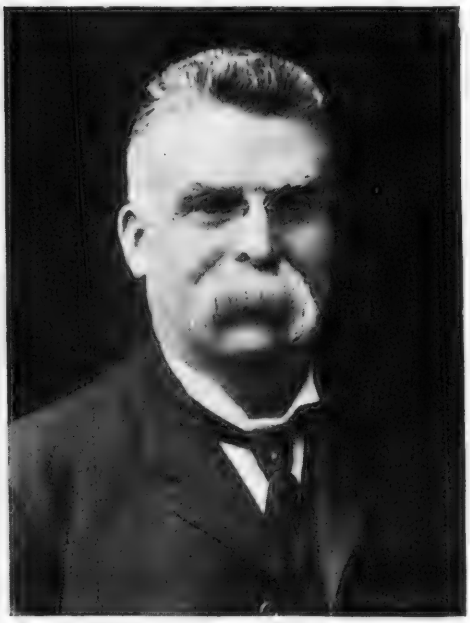
The work is designed to present in a way that any intelligent layman can under-

stand, the principles as well as the practice of all departments of modern engineering and the branches discussed include such subjects as electrical, mechanical, stationary, marine and locomotive engineering, shop practice, tool making, forging, founding, pattern making, heating, ventilation, refrigeration, mechanical drawing, alternating current work, electric lighting and wiring, and telephoning. In treating all of these subjects, the writers have avoided difficult advanced mathematics, and in many other ways have sought to enable the reader to understand the various subjects treated. Upon such subjects as automobiling, the treatment is not only exhaustive, but wholly up to date, and, indeed, in all of the volumes it is evident the writers have kept before them the latest advances made in the engineering world.

The editor-in-chief of the work is Dr. F. W. Gunsaulus, president of Armour Institute of Technology, and no less than 59 writers were engaged in the preparation of the books, including Professor Crocker, of the Department of Electricity in Columbia University; Professor Esty, of the Department of Electricity in Lehigh University; Professor Marks, of Harvard University; Professor Derr, of the Massachusetts Institute of Technology, and Professor Raymond, Dean of the Armour Institute of Technology. In the volume treating of heating and ventilation, no attempt is made to go beyond the essential principles involved, but to those who have acquired their knowledge of the business wholly through shop practice, the book will serve them as a fairly exhaustive review of the technical side of their profession. The books average from 400 to 500 pages, so that in the entire set there are some 6,000 pages of reading matter. The price list for the set is $60.00.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Preparations are going forward for the mid-summer meeting of the society at Chicago, Ill., June 19 and 20 next. Quarters have been secured at the Auditorium Hotel, where the society met last summer, and the same special rates have been offered as were obtained last summer. These rates are $2.00 a day up, on the European plan. A number of papers have already been received by Secretary Mackay for presentation at this meeting. We are also advised that the list of applications for membership, for which ballots have been sent out, contains eighteen new names, and that several additional applications have been received.



JOHN GORMLY, PHILADELPHIA, PA.

President, American Society of Heating and Ventilating Engineers

WILLIAM M. MACKAY, NEW YORK

Secretary, American Society of Heating and Ventilating Engineers

TRADE AND MISCELLANEOUS NOTES

Manufacturers' Notes

Reynolds Heating Co., Warsaw, Ind., is building an addition to its foundry, which will be 43x112 feet.

National Tube Co., Pittsburg, Pa., is making arrangements to build a large galvanizing plant at Lorain, Ohio.

Pittsburgh Valve & Fittings Co., Pittsburg, Pa., is building an addition to its plant at Barberton, Ohio. McClintic-Marshall Construction Company has the contract.

Bayley Heating Co., Milwaukee, Wis., has increased its capital stock from $10,000 to $50,000.

Burley Heating Co., Harrisburg, Pa., had its plant destroyed by fire Saturday, May 19th. The loss is estimated at about $35,000.

Foster Engineering Co., Newark, N. J., is building a 40 x 60-foot addition to its factory, which will have three stories and basement. This, with other alterations, will increase the firm's capacity by 40 per cent. The new building will be equipped with a modern power plant in which belting and shafting will be largely done away with through the use of electricity, generated by a 150 H. P. engine. The boilers to be installed will be capable of standing a pressure of 300 pounds, which will enable the company to test its devices under actual working conditions. Secretary Geortner, of the company, reports a rapid increase in the company's business, resulting in the opening of a number of new branch offices, in all of which full complements of stock are carried. The branch offices of the firm are at 83 East Lake street, Chicago; 631 Arch street, Philadelphia; and 1211 Park Building, Pittsburg.

New Corporations

American Heating & Ventilating Co., Eau Claire, Wis., has been incorporated with a capital of $15,000. The incorporators are: E. E. Scofield, James L. Waterbery and Allen G. McCombs.

Palestine Light, Heat & Power Co., San Antonio, Tex., has been incorporated with a capital of $400,000. The incorporators are: John F. Fitzgerald, Charles W. Lucas, E. Chandler Beach, P. W. Brown and Dudley Bradstreet.

Cleveland Heat & Power Co., Cleveland, Ohio, has been incorporated with a capital of $10,000.

Mutual Plumbing & Heating Co., New York, has been incorporated to

The Albany Return Steam Traps

have been the STANDARD for over THIRTY-TWO YEARS. For returning water under pressure to the boiler, they will perform this duty fully as well, and in many cases better than the so-called steam loop.

Send for circulars A, B, C and D.

MANUFACTURED BY

ALBANY STEAM TRAP CO., ALBANY, N.Y.

FREDERICK TOWNSEND
PRESIDENT

JAMES H. BLESSING
GEN. MGR.

carry on a general repairing business with a capital of $20,000. President, A. P. Thrasher; treasurer, J. H. Lindsay.

Thomas E. Hoye Heating Co., Milwaukee, Wis., has been incorporated with a capital of $10,000 to carry on a heating and ventilating business. The incorporators are: Thomas B. Hoye, John McCoy and J. McCoy.

P. T. Maloney Co., Chicago, Ill., has been incorporated with a capital of $5,000 for manufacturing and dealing in heating plants, etc. The incorporators are: P. T. Maloney, C. F. Cheney and George E. Mohr.

Lorain Heating & Supply Co., Cincinnati, Ohio, has been incorporated with a capital of $30,000. The incorporators are: John Maitland, Clarence E. Doane, Charles R. Meres, Henry Langre and H. F. Waring.

Honeywell Heating Specialty Co., Wabash, Ind., has been incorporated to manufacture heating and plumbing supplies with a capital of $25,000. Directors: M. S. Honeywell, J. C. Teague, M. D. Tillman and H. H. McNamee.

Owen Manufacturing Co., Malden, Mass., has been incorporated with a capital of $15,000 to manufacture heating appliances. The officers are: G. W. Fairfield, president; N. F. Stewart, treasurer; C. H. Coolidge, secretary.

Economical Heating & Lighting Co., Chicago, Ill., has been incorporated with a capital of $5,000. The incorporators are: M. F. Girten, I. Wolfsohn and C. Teller.

Heating & Power Co., Jersey City, N. J., has been incorporated with a capital of $120,000. The incorporators are: Henry MacMillan, Augustus Treadwell and Burgess A. Cruden.

Alton Manufacturing Co., New York, has been incorporated with a capital of $1,500,000 to manufacture lighting and heating apparatus. The directors are: C. F. King, Boston; J. C. Garvin, New York, and L. T. Alton, Brooklyn.

American Valve Co., Coxsackie, N. Y., has been incorporated with a capital of $150,000 to manufacture valves, etc. The incorporators are: George Green, O. L. Whiteman and E. R. Hotaling.

Des Moines Heating & Supply Co., Des Moines, Ia., has been incorporated with a capital of $10,000.

Peer Water Heater Co., Chicago, Ill., has been incorporated with a capital of $100,000 to manufacture heating apparatus. The incorporators are: James McCartney, W. W. Wilmot and Fernando W. Pripps.

Grafton Light, Heat & Power Co., Grafton, Ill., has been incorporated with a capital of $8,500 to operate light, heat and power plants. The incorporators are: L. T. Westrich, C. E. West and Frank D. Haskins.

PIPE HANGERS

Malleable Iron Pipe Hangers and Adjustable Beam Clamps

Send for Catalogue.

FEE & MASON

81 BEEKMAN STREET, N. Y.

"Fat Years"

Many a steam plant wastes heat enough in the "fat years" to make a good profit in the "lean years." If you install

WEBSTER STEAM APPLIANCES

in the "fat years," they will save enough to pay you back with compound interest at the time when you need it most. They save in coal, labor, repairs, stoppages, accidents, and insurance, and yet give you far better service than other appliances.

Write to-day for booklet 17-H.

WARREN WEBSTER & CO. CAMDEN, N. J.

Butler Plumbing & Heating Co., West New York. N. J., has been incorporated with a capital of $5,000 to conduct a plumbing, tinning, steam and hot water heating business.

Lee Heating Co., New York, has been incorporated with a capital of $50,000 to manufacture heating plants and apparatus. The incorporators are: A. C. Edgar, J. H. Lee and F. A. Cox.

Ideal Heating Co., St. Louis, Mo., has been incorporated with a capital of $42,000. The incorporators are: John C. Banks, George M. Harris and Joseph M. Shortal.

Bernard-Greenwood Co., New York, has been incorporated with a capital of $15 000. The incorporators are: Charles Bernard, Jr., W. C. Greenwood and R. W. Bernard.

Sullivan Bros. Plumbing & Heating Co., Chicago. Ill., has been incorporated with a capital of $8,000. The incorporators are: Daniel L. Sullivan, Thomas H. Sullivan and William J. Sullivan.

Couture-Woodhouse Plumbing & Heating Co., Cleveland, Ohio, has been incorporated with a capital of $5,000.

National Plumbing & Heating Co., Springfield, Ill., has been incorporated with a capital of $5,000 to carry on a plumbing and heating business.

New Firms

Swanson Bros., Moline, Ill., have started a contracting, plumbing, gas and steam fitting business at 1213 Sixteenth avenue.

Ryan & Carlson, Superior, Wis., is the name of a new firm which will carry on a heating business at 1809 Broadway.

The Bluff City Heating, Plumbing & Electrical Co., Hannibal, Mo., is the name of a new firm which will conduct a general heating and plumbing business.

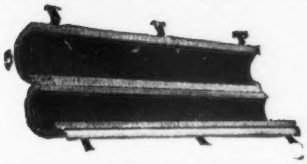
Miscellaneous Notes

The International Steam Pump Company recently called a meeting of its stockholders to increase the preferred stock from $12,500,000 to $15,000,000 and the common stock from $18,000,000 to $24,000,000. With the increase of capital the company will take over the stock of the Power & Mining Machinery Company.

National Association of Manufacturers held its eleventh annual convention at the Waldorf-Astoria, New York, during May, when J. W. Van Cleave, of the Buck's Stove and Range Company, St. Louis, was elected president to succeed David M. Parry.

New Jersey Master Steam and Hot Water Fitters held their first annual meeting at Newark Tuesday, May 15.

"ASBESTOCEL" COVERING



For Hot Water Systems

A marked improvement upon ordinary air cell covering. The corrugations run around the pipe instead of lengthwise and effectually block circulation. Possesses the highest insulating properties and is exceedingly durable. Composed of entirely pure Asbestos, an absolutely fire-proof material. This covering economizes heat and saves greatly in fuel.

Write nearest Branch for Booklet

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Manufacturers of Asbestos and Magnesia Products, Electrical Insulating Materials, "Noark" Fuse Devices, Electrical Railway Supplies, etc.

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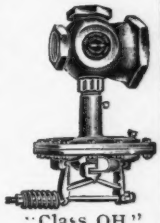
MILWAUKEE PITTSBURG LITTLE ROCK
CHICAGO CLEVELAND SAN FRANCISCO
BOSTON NEW ORLEANS LOS ANGELES
PHILADELPHIA KANSAS CITY SEATTLE
LONDON

166

FOSTER "Class Q" or "Class QH" VALVES

are low pressure devices for steam heating purposes and there are no better made, no more dependable valves for controlling low pressure delivery.



"Class QH" Valve

"Class QH" Valve has a small inlet and a large outlet to permit the use of a valve smaller than the delivery pipe.

"Class Q" Valve

Send for our catalog giving a full description of all Foster Valve Specialties.

Foster Engineering Co.,
NEWARK, N. J.

The following officers were elected: President, Sol Berla, Newark; vice-president, Joel S. Boyce, Asbury Park; secretary-treasurer, Harry Geiser, Newark. Board of Directors: T. B. Cryer, E. R. Soleau, Harry Geiser, all of Newark, A. F. Van Cleve, Ocean Grove, and Joel S. Boyce, Asbury Park.

The American Society of Refrigerating Engineers has issued its 1906 year book, containing the society's constitution and by-laws and list of officers and members. The list contains the names of 119 members, including a number of heating engineers, among whom we note Prof. R. C. Carpenter and Albert A. Cary. Copies of the booklet may be had by addressing the secretary at Suite 806, 258 Broadway, New York.

The Society for the Promotion of Engineering Education will hold its fourteenth annual meeting at Ithaca, N. Y., June 29 to July 4. The meeting will be held in affiliation with Section D of the Association for the Advancement of Science.

Thomas Morrin, Consulting Engineer, Mills Building, San Francisco, Cal., mentions the loss of his reference library in the San Francisco fire and would thank the trade to send him copies of their catalogues and such data as might be useful to him.

Business Changes

Lockhart Heating, Plumbing & Manufacturing Co., Moline, Ill., has increased its capital stock to $6,000. The officers of the company are: T. D. Wheelock, president; A. M. Deane, vice-president; and A. F. Lockhart, secretary-treasurer.

O'Neill Water Heating Co., Peoria, Ill., has increased its capital stock from $25,000 to $100,000.

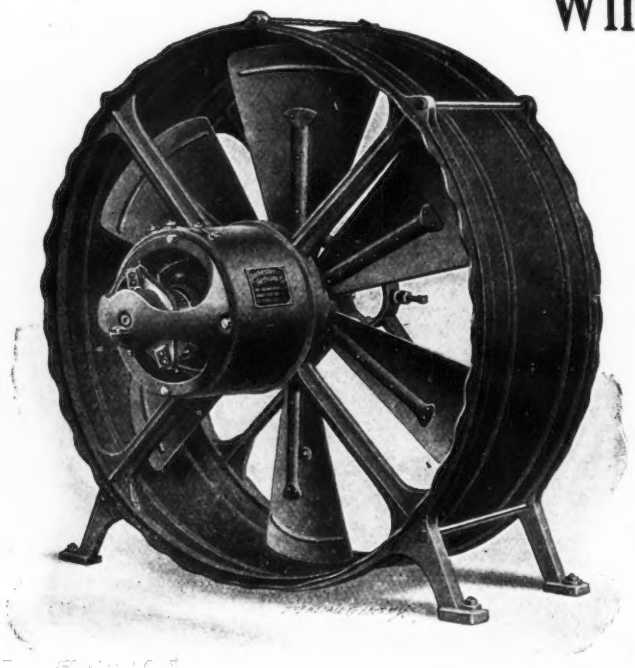
Plumbing & Heating Publishing Co., New York, announces the removal of its offices to 150 Nassau street. Gilbert G. McDuff, manager of the company, is engaged in the preparation of the second edition of the Plumbing and Heating Buyers' Directory.

Gurney Heater Manufacturing Co., Boston, Mass., has moved its general offices and showrooms to 188-200 Franklin street.

Kinnear Pressed Radiator Co., Pittsburg, Pa., has located its Pacific Coast offices at 922 Franklin street, San Francisco.

Norwall Manufacturing Company has moved its Chicago office to 154 Lake street, Chicago.

American Radiator Company has secured new headquarters for its San Francisco office since the date of its recent announcement. The company's San Francisco office is now located at 1317 Gough street.



Wing's Disc Fans

FOR FORCING OR EXHAUSTING AIR

The Original
The Strongest
The Most Efficient

Send for Catalogue and Reference List of some 800 names of users.

MANY THOUSANDS IN USE

L. J. WING MFG. CO.
136 Liberty Street, New York

Manufacturers of

WING'S Disc Fan and Combinations
WING'S Fans and Turbine Engines for Forced Draft, etc.
WING'S High Speed Steam Engines
WING'S Acetylene Generators, etc.

Contracts Awarded

A. & S. Wilson, Pittsburg, Pa., construction of McCrum-Howell Company's new enameled ware plant at Uniontown, Pa., which will cost $150,000.

Jacob Sykes, Northfield, Minn., installing the heating plant in the new Odd Fellows' Orphans' Home.

J. J. Hanighen, Omaha, Neb., installing the heating and ventilating apparatus in the Brandeis building, the consideration being $53,500.

Willard & Marshall, Whitehall, N. Y., installing a hot air and hot water system in an office building on Broad street.

Gorman Plumbing Co., Salt Lake City, Utah, heating and plumbing the High School gymnasium. The contract price is $4,120.

A. B. Wheeler & Son, Wausaw, Wis., plumbing and heating the High School building in Medford, Wis.

L. R. Helbing & Co., Duluth, Minn., heating and ventilating the new school at West Duluth. The bid was $8,577. Also heating and ventilating the Sixth Street School for $8,963.

Modern Heating Co., Wilkinsburg, Pa., heating the new apartment building of John R. Jumurmas on Mifflin avenue.

Archambo Heating & Plumbing Co., Minneapolis, Minn., heating and ventilating the women's building at the State University.

George Faiszt, Grayville, Ill., installing a new steam heating plant in the Grayville public school. The contract is worth $1,490.

W. J. Lewis & Co., New York, heating the new Union National Bank building.

Lewis & Kitchen, Kansas City, Mo., heating the Lykins School.

Hankee & Eha, St. Paul, Minn., installing the heating plants in the Maxfield and Gorman schools.

Charles F. Thompson Plumbing Co., Stamford, Conn., plumbing and heating the Stamford Yacht Club building.

E. J. Rohrbach Bros., Reading, Pa., installing the steam heating plant in the store of C. D. Trexler & Son.

M. Toye, Winona, Minn., heating the High School, at his bid of $8,330.

McLaurin & Northrop, Mankato, Minn., heating a new hospital. Their bid was $2 845.

E. S. Babcock & Son, Milton, Wis., steam heating Whitford Memorial Hall. The consideration is $3,400.

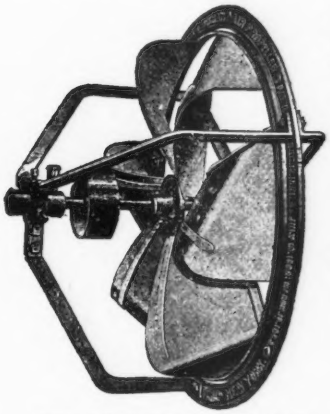
O. F. Peters, Cannon Falls, Minn., installing a new heating plant in the school building, at his bid of $2,500.

E. Eastham, Beaumont, Tex., installing a steam heating apparatus in the county jail. The consideration was $4,100.

T. C. King, East Liverpool, Ohio, hot water heating C. A. Smith's $15,000 residence at Chester, W. Va.

P. F. Maginn, Pittsburg, Pa., heating the Commonwealth Trust Company building.

Harry F. Murphy, Philadelphia, Pa., heating the new East Liberty Station of the Pennsylvania Railroad.



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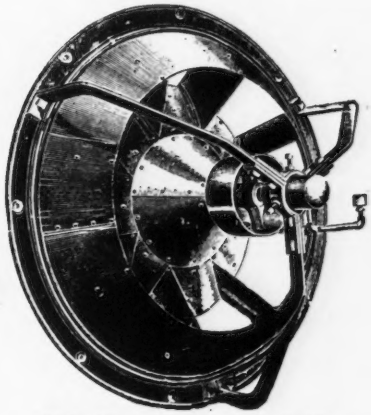

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MANUFACTURERS, ENGINEERS AND CONTRACTORS

J. L. Mayer, Winona, Minn., plumbing, heating and electric wiring the new city jail, at his bid of $2,400.

P. J. Gallagher, Fairibault, Minn., plumbing and heating two new buildings for the State School for Feeble Minded.

McGinnis & Smith Co., Pittsburg, Pa., heating the new Masonic Temple at McKeesport, Pa.; also heating the Masonic Temple at New Brighton, Pa.

Steinhofer & Vanslike, Minot, N. D., plumbing and heating the new Robbins block.

Sproul & McGurrin, Grand Rapids, Mich., plumbing and heating the Sigsbee Street School, at their bid of $11,000.

James Hay Co., Allegheny, Pa., heating the new station of the Pennsylvania Railroad in Allegheny City.

Schell Hardware Co., Connellsville, Pa., heating the store and apartment block of the First National Bank, Dunbar, Pa.

Clark E. Reed, Davenport, Ia., heating the new fire station on Fourth street.

American Warming & Heating Co., Pittsburg, Pa., heating a schoolhouse at East Pittsburg, Pa.

Worth & Winterbottom, Fall City, Neb., installing a steam heating plant in the new high school building at Edgar. The contract is worth $2,673.

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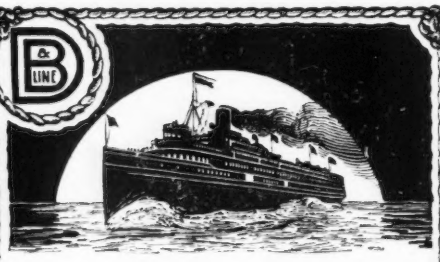

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